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For related information see also *Astronautics*.

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**81 ADMINISTRATION AND MANAGEMENT** **708**
Includes management planning and research.

**82 DOCUMENTATION AND INFORMATION SCIENCE** **709**
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

**83 ECONOMICS AND COST ANALYSIS** **711**
Includes cost effectiveness studies.

**84 LAW AND POLITICAL SCIENCE** **N.A.**
Includes space law; international law; international cooperation; and patent policy.

**85 URBAN TECHNOLOGY AND TRANSPORTATION** **712**
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

**SPACE SCIENCES**

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

**88 SPACE SCIENCES (GENERAL)** **713**

**89 ASTRONOMY** **714**
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

**90 ASTROPHYSICS** **714**
Includes cosmology; and interstellar and interplanetary gases and dust.

**91 LUNAR AND PLANETARY EXPLORATION** **715**
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

**92 SOLAR PHYSICS** **N.A.**
Includes solar activity, solar flares, solar radiation and sunspots.

**93 SPACE RADIATION** **N.A.**
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

**GENERAL**

**99 GENERAL** **716**

**Note: N.A. means that no abstracts were assigned to this category for this issue.**

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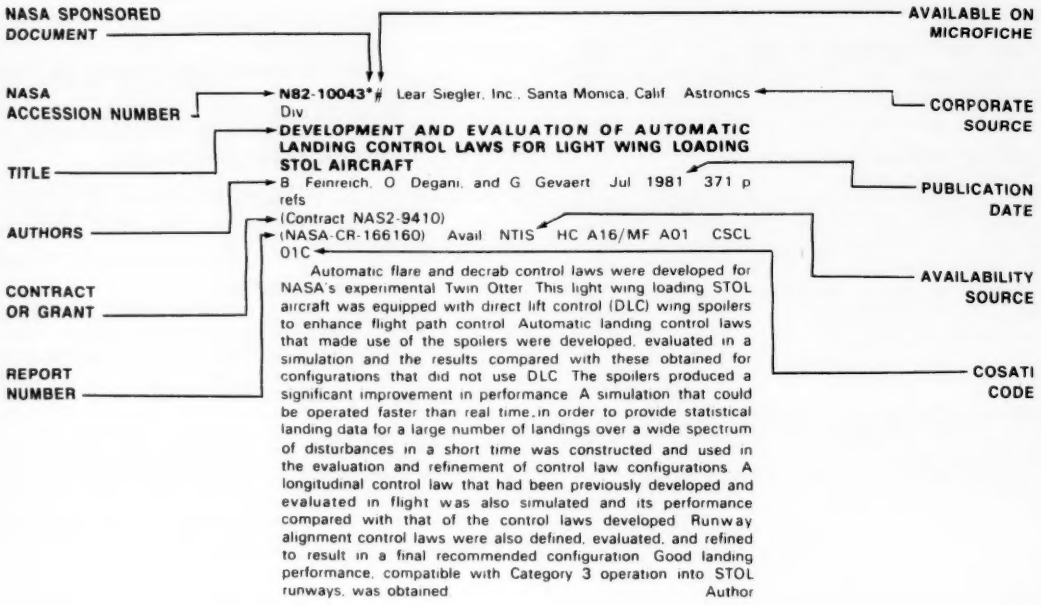
# TYPICAL CITATION AND ABSTRACT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TITLE
DEVELOPMENT AND EVALUATION OF AUTOMATIC LANDING CONTROL LAWS FOR LIGHT WING LOADING STOL AIRCRAFT
PUBLICATION DATE
AUTHORS
B. Feinreich, O. Degani, and G. Gevaert Jul. 1981 371 p refs
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(Contract NAS2-9410)
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REPORT NUMBER
(NASA-CR-166160) Avail: NTIS HC A16/MF A01 CSCL 01C
COSATI CODE
Automatic flare and decrab control laws were developed for NASA's experimental Twin Otter. This light wing loading STOL aircraft was equipped with direct lift control (DLC) wing spoilers to enhance flight path control. Automatic landing control laws that made use of the spoilers were developed, evaluated in a simulation and the results compared with these obtained for configurations that did not use DLC. The spoilers produced a significant improvement in performance. A simulation that could be operated faster than real time, in order to provide statistical landing data for a large number of landings over a wide spectrum of disturbances in a short time was constructed and used in the evaluation and refinement of control law configurations. A longitudinal control law that had been previously developed and evaluated in flight was also simulated and its performance compared with that of the control laws developed. Runway alignment control laws were also defined, evaluated, and refined to result in a final recommended configuration. Good landing performance, compatible with Category 3 operation into STOL runways, was obtained. Author

VOLUME 20 NUMBER 5 MARCH 8, 1982

# Scientific and Technical Aerospace Reports

*A Semimonthly Publication of the National Aeronautics and Space Administration*

## 01 AERONAUTICS (GENERAL)

**N82-14049*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**OPTIMIZATION AND PERFORMANCE CALCULATION OF DUAL-ROTATION PROPELLERS**
Robert E. Davidson Dec. 1981 48 p refs
(NASA-TP-1948; L-14678) Avail: NTIS HC A03/MF A01 CSCL 01A

An analysis is given which enables the design of dual-rotation propellers. It relies on the use of a new tip loss factor deduced from T. Theodorsen's measurements coupled with the general methodology of C. N. H. Lock. In addition, it includes the effect of drag in optimizing. Some values for the tip loss factor are calculated for one advance ratio. Author

## 02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

**N82-14050#** Institut fuer Theoretische Stroemungsmechanik, Goettingen (West Germany).
**COMPUTATION OF SUBSONIC FLOW AROUND AIRFOIL SYSTEMS WITH MULTIPLE SEPARATION**
Klaus Jacob 1981 63 p refs In GERMAN
(DFVLR-FB-81-24) Avail: NTIS HC A04/MF A01

A numerical method for computing the subsonic flow around multielement airfoil systems was developed, allowing for flow separation at one or more elements. Besides multiple rear separation, short bubbles on the upper surface and cove bubbles are taken into account. Compressibility effects for pure subsonic flow are approximately accounted for. S.L.

**N82-14051*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ANALYTIC INVESTIGATION OF EFFECT OF END-WALL CONTOURING ON STATOR PERFORMANCE**
Robert J. Boyle, Harold E. Rholik, and Louis J. Goldman Nov. 1981 12 p refs
(NASA-TP-1943; E-719) Avail: NTIS HC A02/MF A01 CSCL 01A

Calculations show improved stator performance when the tip end wall was contoured so that the inlet area was greater than the exit area. Comparisons are made with previously published experimental data. The results of a parametric analysis of the effect contour geometry on the efficiency of a highly loaded axial stator are given. The maximum stator efficiency gain is about 0.8 percentage point, and this represents a 22 percent reduction in stator losses. The degree to which endwall contouring reduces the forces driving secondary flows was also examined. The driving forces for both cross channel and radial secondary flow were reduced. T.M.

**N82-14052*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF AXISYMMETRIC SUPERSONIC CRUISE NOZZLE GEOMETRY AT MACH NUMBERS FROM 0.60 TO 1.30**
George T. Carson, Jr. and Edwin E. Lee, Jr. Dec. 1981 89 p refs
(NASA-TP-1953; L-14661) Avail: NTIS HC A04/MF A01 CSCL 01A

Quantitative pressure and force data for five axisymmetric boattail nozzle configurations were examined. These configurations simulate the variable-geometry feature of a single nozzle design operating over a range of engine operating conditions. Five nozzles were tested in the Langley 16-Foot Transonic Tunnel at Mach numbers from 0.60 to 1.30. The experimental data were also compared with theoretical predictions. B.W.

**N82-14053*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**STABILITY AND CONTROL CHARACTERISTICS OF A MONOPLANAR MISSILE CONFIGURATION WITH TRIFORM-TAIL-FIN ARRANGEMENTS AT MACH NUMBERS FROM 1.70 TO 2.86**
Milton Lamb Dec. 1981 119 p refs
(NASA-TM-83223; L-14724) Avail: NTIS HC A06/MF A01 CSCL 01A

A wind-tunnel missile model with either a lower vertical tail fin with a pair of horizontal fins having 0 deg, 22.5 deg, or 30 deg dihedral or an upper vertical tail fin with horizontal fins having 0 deg, -22.5 deg, or -30 deg dihedral was investigated. The results indicated that those configurations with horizontal fins at or below the horizontal plane had nearly linear pitching-moment characteristics, while those with the horizontal fins above the horizontal plane experienced pitch-up which increased with increasing horizontal-fin-dihedral angle. At zero angle of attack, the configurations were directionally stable at most test Mach numbers. Generally, those configurations with the upper vertical fin had positive effective dihedral at zero angle of attack, while those with he lower vertical fin had negative effective dihedral. For roll control, three deflected tail fins produced more total roll control than two horizontal fins. For yaw control, three tail fins deflected equally or differentially produced more total yaw control than the single vertical fin. B.W.

**N82-14054*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**PRESSURE DISTRIBUTIONS AND SHOCK SHAPES FOR 12.84 DEG/7 DEG ON-AXIS AND BENT-NOSE BICONICS IN AIR AT MACH 6**
Charles G. Miller, III and Peter A. Gnoff Dec. 1981 127 p refs
(NASA-TM-83222; L-14896) Avail: NTIS HC A07/MF A01 CSCL 01A

Pressure distributions and shock shapes on a spherically

blunted, 12.84 deg /7 deg on axis biconic and a spherically blunted, 12.84 deg/7 deg bent nose biconic at Mach 6 in air were measured. The angle of attack, referenced to the axis of aft cone, was varied from 0 deg to 25 deg in nominal 5 deg increments. Two values of free stream Reynolds number based on model length were tested. Predictions from simple, theories and from a supersonic, three dimensional, external invsicid code (STEIN) are compared with measured values. Predicted STEIN shock shapes and windward pressures are in agreement with measured values for both biconics over the present range of angle of attack. E.A.K.

**N82-14055*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**COMPARISON OF EXPERIMENTAL AND THEORETICAL TURBULENCE REDUCTION CHARACTERISTICS FOR SCREENS, HONEYCOMB, AND HONEYCOMB-SCREEN COMBINATIONS**

James Scheiman Dec. 1981 55 p refs
(NASA-TP-1958; L-14628) Avail: NTIS HC A04/MF A01 CSCL 01A

Turbulence reduction research using screens, honeycomb, and combinations thereof was conducted in a half-scale model of a portion of the Langley 8-foot transonic pressure tunnel. It was found that screens alone reduce axial turbulence more than lateral turbulence; whereas, honeycomb alone reduces laterial turbulence more than axial turbulence. Because of this difference, the physical mechanism for decreasing turbulence for screens and honeycomb must be completely different. It is concluded that honeycomb with a downstream screen is an excellent combination for reducing turbulences. E.A.K.

**N82-14056*#** National Aeronautics and Space Administration, Washington, D. C.

**SYSTEM FOR ACQUISITION AND ANALYSIS OF DYNAMIC TESTS ON AIR INTAKES**

P. Perrier, B. Delahaye (SNECMA, Moissy-Cramayel, France), and G. Laruelle (ONERA, Paris) Dec. 1981 54 p refs Transl. into ENGLISH of "Systeme d'Acquisition et d'Analyse pour Essais Dynamiques d'Entees d'Air", Rept. ONERA-TP-1981-37 ONERA, France, 1981 15 p Presented at the AGARD Symp. on Aerodyn. of Power Plant Installation, Toulose, 11-14 May 1981 Original language document was announced as A81-39240 Transl. by Scientific Translation Service, Santa Barabara, Calif. Original doc. prep. by Avions Marcel Dassault-Brequet Aviation
(Contract NASw-3542)
(NASA-TM-76646) Avail: NTIS HC A04/MF A01 CSCL 01A

The problem of compatibility between the airflow developed through the aircraft's air intake ducting and its suitability to the jet engine are studied. A review of the various functions of the air intake is presented. A proposed solution to measure the various parameters is described. The specifications and details of the system permit measurements with a satisfactory reliability on the test bench, as well as in the wind tunnel or in flight. R.J.F.

**N82-14057*#** National Aeronautics and Space Administration, Washington, D. C.

**EXPERIMENTAL INVESTIGATION OF A TRANSONIC POTENTIAL FLOW AROUND A SYMMETRIC AIRFOIL**

W. J. Hiller and G. E. A. Meier Dec. 1981 26 p refs Transl. into ENGLISH from Rept. 10/1971 Max-Planck Inst. fuer Stroemungsforschung, Goettingen, W. Germany, Nov. 1971 22 p Original language document was announced as N72-19996 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3541)
(NASA-TM-76676; Rept-10/1971) Avail: NTIS HC A03/MF A01 CSCL 01A

Experimental flow investigations on smooth airfoils were done using numerical solutions for transonic airfoil streaming with shockless supersonic range. The experimental flow reproduced essential sections of the theoretically computed frictionless solution. Agreement is better in the expansion part of the of the flow than in the compression part. The flow was nearly stationary in the entire velocity range investigated. Author

**N82-14058*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**A FLIGHT INVESTIGATION OF BLADE-SECTION AERODYNAMICS FOR A HELICOPTER MAIN ROTOR HAVING 10-64C AIRFOIL SECTIONS**

Charles E. K. Morris, Jr. Nov. 1981 181 p refs
(NASA-TM-83226) Avail: NTIS HC A09/MF A01 CSCL 01A

Pressure data at 90 percent blade radius were obtained for a helicopter main rotor with 10-64C blade sections during flight. Concurrent measurements were made of vehicle flight state, performance and some rotor loads. The test envelope included hover, level flight from about 65 to 162 knots, climb and descent, and collective fixed maneuvers. Good agreement is shown between some sets of airfoil pressure distributions obtained in flight and those from two-dimensional wind-tunnel tests or theoretical calculations. A.R.H.

**N82-14059*#** Low Energy Transport Systems, Capistrano Beach, Calif.

**LOW REYNOLDS NUMBER AIRFOIL SURVEY, VOLUME 1 Final Report**

B. H. Carmichael Nov. 1981 106 p refs
(NASA Order L-4059B)
(NASA-CR-165803-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 10A

The differences in flow behavior two dimensional airfoils in the critical chordlength Reynolds number compared with lower and higher Reynolds number are discussed. The large laminar separation bubble is discussed in view of its important influence on critical Reynolds number airfoil behavior. The shortcomings of application of theoretical boundary layer computations which are successful at higher Reynolds numbers to the critical regime are discussed. The large variation in experimental aerodynamic characteristic measurement due to small changes in ambient turbulence, vibration, and sound level is illustrated. The difficulties in obtaining accurate detailed measurements in free flight and dramatic performance improvements at critical Reynolds number, achieved with various types of boundary layer tripping devices are discussed. E.A.K.

**N82-14060#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**ACTA MECHANICA SINICA (SELECTED ARTICLES)**

20 Oct. 1981 37 p refs Transl. into ENGLISH from Acta Mech. Sinica (Communist China), no. 3, 1980 p 217-231, 302-310
(AD-A107322; FTD-ID(RS)T-0709-81) Avail: NTIS HC A03/MF A01 CSCL 01/1

Simplified Navier-Stokes equations, their mathematical properties, and equations of flight mechanics used in analyzing the effects of wind and atmospheric turbulence on flight performance are presented. Lifting surface theory for wings in low frequency small amplitude yawing and side slipping oscillating motions at low speeds is also presented. For individual titles, see N82-14061 through N82-14063.

**N82-14061#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**LIFTING SURFACE THEORY FOR WINGS IN LOW FREQUENCY SMALL AMPLITUDE YAWING AND SIDE SLIPPING OSCILLATING MOTIONS AT LOW SPEEDS**

Huang Mingke *In its* Acta Mech. Sinica (Selected Articles) (FTD-ID(RS)T-0708-81) 20 Oct. 1981 p 1-15 refs Transl. into ENGLISH from Acta Mech. Sinica (Communist China), no. 3, 1980 p 217-231, 302-310 (For primary document see N82-14060 05-02)
Avail: NTIS HC A03/MF A01 CSCL 01/1

The mathematical problem of flow at low speeds past a yawing oscillating wing set up by using a coordinate system fixed in the wing is discussed. The snake-like tail vortices behind the wing are investigated in detail. In the case of low frequency oscillations, numerical solution is obtained by the non-steady vortex-lattice method which can be used to calculate the rolling moment aerodynamic derivatives of the wing due to yaw and side slip. Some of the computed results are compared with the experimental results. Author

**N82-14062#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**SIMPLIFIED NAVIER-STOKES EQUATIONS AND THEIR MATHEMATICAL PROPERTIES**

Wang Ruquan, Liu Xue Zong, Jiao Luquong, and Gao Zhi *In its* Acta Mech. Sinica (Selected Articles) (FTD-ID(RS)T-0708-81) 20 Oct. 1981 p 16-27 refs Transl. into ENGLISH from Acta Mech. Sinica (Communist China), no. 3, 1980 p 217-231, 302-310 (For primary document see N82-14060 05-02)
HC A03/MF A01 CSCL 01/1

Two-dimensional simplified Navier-Stokes equations are analyzed qualitatively. It is concluded that the above equations are ill-posed when the tangential flow velocity component u < c(c) is the local sound velocity. Hence, instability arises in numerical solutions. The proper specification of initial and boundary value conditions of supersonic viscous flow around a sphere-cone body is also discussed. Author

**N82-14063#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

**EQUATIONS OF FLIGHT MECHANICS CONSIDERING ATMOSPHERIC TURBULENCE**

Jiang Yu-xian *In its* Acta Mech. Sinica (Selected Articles) (FTD-ID(RS)T-0708-81) 20 Oct. 1981 p 28-34 refs Transl. into ENGLISH from Acta Mech. Sinica (Communist China), no. 3, 1980 p 217-231, 302-310 (For primary document see N82-14060 05-02)
Avail: NTIS HC A03/MF A01 CSCL 01/1

The effect of wind on the flight performance, starting from the difference between the relative motion and the absolute motion, is discussed. The general form of the flight mechanics equations with wind are derived, The vector forms of the weight, air speed, ground speed, wind speed, aerodynamic force, thrust, aerodynamic moment, angular velocity relative to the air, angular velocity relative to the ground of the flying vehicle and the angular velocity of the air are simplified for fflight mechanics equations. The body coordinate system is Oxyz and the inertial coordinate system is O sub g x sub g y sub g z sub g. It is concluded that the relative motion and the absolute motion of the equations of flight mechanics with wind should be distinguished. M.D.K.

**N82-14064#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. High Speed Aero Performance Branch.

**EVALUATION OF USSAERO AND HABP COMPUTER CODES FOR AERODYNAMIC PREDICTIONS FOR SLENDER BODIES Final Report, Oct. 1979 - Jul. 1980**

Jack I. Flaherty Sep. 1981 105 p refs
(AF Proj. 2404)
(AD-A106065; AFWAL-TR-81-3035) Avail: NTIS HC A06/MF A01 CSCL 20/4

This study has been conducted to evaluate the merits and limitations of a subsonic and a supersonic analysis method used frequently in Government and Industry for predicting aerodynamic characteristics. Specifically the Unified Subsonic-Supersonic Aerodynamic Computer Program (USSAERO) was evaluated at Mach 0.4 for the subsonic case. The Supersonic-Hypersonic Arbitrary Body Program (HABP) was evaluated for the supersonic case beginning at a low Mach number of 1.50 and systematically increasing to Mach 4.63. Model geometries have been restricted to simple axisymmetric ogive forebody cylindrical afterbody combinations to aid in the relative comparison of the method capabilities. For the supersonic comparisons a data base was selected that featured a wide variety of nose bluntness and fineness ratios to determine their impact on the analysis capabilities. Specific limitations of the methods are identified from comparisons with detailed body pressure coefficient data. Author (GRA)

**N82-14065#** Ballistic Research Labs., Aberdeen Proving Ground, Md.

**NUMERICAL SIMULATION OF STEADY SUPERSONIC FLOW OVER AN OGIVE CYLINDER BOATTAIL BODY Final Report**

Lewis B. Schiff and Walter B. Sturek Sep. 1981 50 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A106060; ARBRL-TR-02363) Avail: NTIS HC A03/MF A01 CSCL 20/4

A recently reported Parabolized Navier-Stokes code has been employed to compute the supersonic flow field surrounding an ogive-cylinder-boattail body at incidence. The computations were performed for flow conditions where an extensive series of experimental surface pressure and turbulent boundary-layer profile measurements had been obtained. Comparison between the computational results and experimental measurements for angles of attack up to 6 deg. show excellent agreement. At angles greater than 6 deg. discrepancies are observed which are tentatively attributed to three-dimensional turbulence modeling errors. Author (GRA)

**N82-14066#** Ballistic Research Labs., Aberdeen Proving Ground, Md.

**COMPUTATIONAL PARAMETRIC STUDY OF THE AERODYNAMICS OF SPINNING SLENDER BODIES AT SUPERSONIC SPEEDS Final Report**

Walter B. Sturek, Donald C. Mylin, and Clarence C. Bush Aug. 1981 40 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A106074; ARBRL-TR-02358) Avail: NTIS HC A03/MF A01 CSCL 20/4

Three dimensional finite-difference flow field computation techniques have been employed to generate a parametric aerodynamic study at supersonic speeds. Computations for viscous turbulent and inviscid flow have been performed for cone-cylinder, secant-ogive-cylinder, and tangent-ogive-cylinder bodies for a Mach number range of 1.75 < or = M < or = 5. The aerodynamic coefficients computed are pitching moment, normal force, center of pressure, Magnus moment, Magnus force, Magnus center of pressure, form drag, viscous drag, roll damping and pitch damping. All aerodynamic coefficients are computed in a conceptually exact manner. The only empirical input is that required for turbulence modeling. Computed results are compared to experimental data from free flight aerodynamic ranges and wind tunnels in order to validate the computational techniques. parametric comparisons illustrate the effects of body configuration and Mach number for the ten aerodynamic coefficients. The results for Magnus and pitch damping are of particular interest. Author (GRA)

**N82-14067#** General Dynamics Corp., Fort Worth, Tex.

**AN EMPIRICAL METHOD FOR ESTIMATING THE EFFECT OF GROUND PROXIMITY ON THE JET-INDUCED LIFT OF V/STOL AIRCRAFT EMPLOYING RECTANGULAR JETS**

J. A. Sansone and W. H. Foley Aug. 1981 154 p refs
(Contract N62269-80-C-0238)
(AD-A105668; NADC-79298-60) Avail: NTIS HC A08/MF A01 CSCL 20/4

An empirical method has been developed to predict the propulsive-induced forces on a V/STOL aircraft hovering in proximity of the ground. This method is applicable to configurations employing two, three, or four rectangular exhausts. Planform contour, nozzle pressure ratio, and lift improvement devices are considered. Accuracies on the order of one percent of propulsive thrust are demonstrated. Author (GRA)

**N82-14068#** Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.

**MODULAR ASYMMETRIC PARACHUTE FOR WIND-TUNNEL TESTING**

P. C. Klimas, H. E. Widdows, and R. H. Croll 1981 16 p refs Presented at the 7th AIAA Aerodyn. Decelerator and Balloon Technol. Conf., San Diego, Calif., 21 Oct. 1981
(Contract DE-AC04-76DP-00789)
(DE81-028416; SAND-78-1744C; CONF-811002-2) Avail: NTIS HC A02/MF A01

The construction of a series of asymmetrical wind tunnel model parachutes designed to a modular concept is described. The static force, inflation force, and dynamic force and motion time history wind tunnel testing of up to 123 different configurations is discussed. DOE

**N82-14069#** European Space Agency, Paris (France).

**HYPERSONIC SLIP-FLOW AROUND SLENDER ELLIPTICAL CONES AT A SLIGHT ANGLE OF ATTACK Ph.D. Thesis - Rheinisch-Westfaelischen Technischen Hochsule, West Germany**

Panajotis Evangelou Sep. 1981 122 p refs Transl. into ENGLISH of "Hypersonische Gleitstroemung um schwach angestellte schlanke elliptische Kegel", DFVLR-FB-79-21 DFVLR, Goettingen, West Germany, May 1979 Original report in GERMAN previously announced as N80-25301
(ESA-TT-644; DFVLR-FB-7921) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 19.20

A method is developed for calculating the hypersonic slip flow around elliptical cones at low angles of incidence. Using orders of magnitude a system of partial nonlinear differential equations of second order and parabolic character is derived from the Navier-Stokes equations and the energy equation; this system describes the flow in the shock formation region. The system of differential equations is integrated using an explicit finite difference procedure. The results obtained are compared with test results and the results of other theoretical flow field investigations. The influence of the axis ratio of the elliptical cone section and of the angle of incidence on the development of the flow field in the shock formation region is investigated. For small angles of incidence, to an elliptical cone, the cross flow appears only slowly, or not at all, whereas at moderate incidences, because of the large expansion, a marked cross flow occurs around the ridge line. This expansion and cross flow become more marked with increasing ellipticity of the conical section and with increasing incidence. Author (ESA)

**N82-14070#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Instationaere Aerodynamik.
**TIME LINEARIZED CALCULATION OF TWO DIMENSIONAL UNSTEADY TRANSONIC POTENTIAL FLOW AT SMALL DISTURBANCES**
Ralph Voss Oct. 1980 88 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-728)
(DFVLR-FB-81-01) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 20

An integral equation method for calculating unsteady transonic flow fields around oscillating airfoils at small disturbances was investigated. The procedure is based on separating the velocity potential into steady and unsteady parts and linearizing the resulting unsteady differential equation under the assumption of harmonic oscillations of small amplitudes. Use of Green's theorem results in two coupled integral equations for a doublet distribution at the profile and a source distribution in the whole flow field. Neglecting far field influences, the equations are discretized in a finite area and solved by iteration. The influences of discretization and limitation of the field are shown by results for a NACA 64A 006 profile. Author (ESA)

**N82-14968*#** Saint Louis Community Coll. at Meramec, Mo.
**WHY USE CASE STUDIES RATHER THAN SIMULATION-GAMING TECHNIQUES OR LIBRARY RESEARCH?**
Susan W. McDonald *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 99-103 refs (For primary document see N82-14960 05-82)
Avail: NTIS HC A14/MF A01 CSCL 05B

# 03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

**N82-14071#** Arinc Research Corp., Annapolis, Md.
**THE USE OF FLIGHT MANAGEMENT COMPUTERS IN AIR CARRIER OPERATIONS IN THE 1980S Interim Report**
I. Gershkoff Washington FAA Aug. 1981 113 p refs
(Contract DTFA01-80-C-10030)
(AD-A105621; Rept-1378-11-1-2482; FAA-EM-81-10) Avail: NTIS HC A06/MF A01 CSCL 09/2

The use of on-board flight management computers (FMCs) in air carrier operations has the potential for significant fuel savings. This report assesses the general capabilities of the FMCs currently available. From this information, economic benefits and rates at which aircraft would be equipped were developed. Minimum-cost flight profiles were analyzed for various common conditions to determine the problems associated with incorporating the capabilities of FMCs into a heavy traffic Air Traffic Control environment. GRA

**N82-14072#** Hamilton Standard, Windsor Locks, Conn.
**ADVANCED CRASH SURVIVABLE FLIGHT DATA RECORDER AND ACCIDENT INFORMATION RETRIEVAL SYSTEM (AIRS) Final Report, Oct. 1978 - Dec. 1980**
Henry R. Ask, Donald L. White, and Kent E. Berwick Fort Eustis, Va. Army Research and Technology Labs. Aug. 1981 166 p refs
(Contract DAAK51-78-C-0025; DA Proj. 1L1-62209-AH-76) (AD-A105510; ESP-8109; USAAVRADCOM-TR-81-D-20) Avail: NTIS HC A08/MF A01 CSCL 01/3

The Accident Information Retrieval System, (AIRS) development program consisted of four phases. Design concepts were formulated based on selection and definition of aircraft parameters to be monitored by the AIRS, selection of memory technology, circuit definitions for aircraft interfacing, and studies and tests related to the development of an armored module to protect the memory device. Brassboard electronics were fabricated and tested and software which proved the feasibility of data collection and storage in a solid-state memory device utilizing unique data compression techniques to reproduce critical aircraft flight information was developed and tested. Flight-worthiness assurance tests were performed on the AIRS brassbroad. The hardware was installed in a Sikorsky UH-60A BLACK HAWK helicopter. The system was reviewed for final configuration, risk areas, final size (207 cu. in. or less), weight (less than 9.3 lbs.), and life cost (greater than 10,000 hours MTBF). GRA

# 04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

**N82-14073#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
**ANALYSIS OF TWO AIR TRAFFIC SAMPLES IN THE TERMINAL AREA OF FRANKFURT/MAIN, AUGUST 4TH 1978**
Uwe Voelckers, Manfred Schubert, and Albrecht Seyfried 1981 127 p refs In GERMAN
(DFVLR-Mitt-81-12) Avail: NTIS HC A07/MF A01

Two 'arrival peaks' are analyzed. Computer programs used to combine data recorded from several sources are discussed. Traffic analysis includes quantitative evaluation of traffic density, studies of air traffic distributions relating to space and time, investigation of air traffic control procedures, determination of the approach control planning strategies, and a basic investigation of traffic vectoring in the terminal area. The similarities and differences of the two traffic samples are discussed. N.W.

**N82-14074*#** Texas A&M Univ., College Station. Dept. of Electrical Engineering.
**DESIGN STUDIES FOR A TECHNOLOGY ASSESSMENT RECEIVER FOR GLOBAL POSITIONING SYSTEM**
John H. Painter 15 Dec. 1981 120 p refs
(Grant NsG-1639)
(NASA-CR-165046) Avail: NTIS HC A06/MF A01 CSCL 17G

The operational conditions of a radio receiver - microprocessor for the global positioning system are studied. Navigation fundamentals and orbit characterization are reviewed. The global positioning system is descrbied with emphasis upon signal

structure and satellite positioning. Ranging and receiver processing techniques are discussed. R.J.F.

**N82-14075*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**DESIGN AND IMPLEMENTATION OF A TELECOMMUNICATION INTERFACE FOR THE TAATM/TCV REAL-TIME EXPERIMENT**
Joseph D. Nolan Dec. 1981 26 p refs
(NASA-TM-83231; L-15021) Avail: NTIS HC A03/MF A01 CSCL 17G

The traffic situation display experiment of the terminal configured vehicle (TCV) research program requires a bidirectional data communications tie line between an computer complex. The tie line is used in a real time environment on the CYBER 175 computer by the terminal area air traffic model (TAATM) simulation program. Aircraft position data are processed by TAATM with the resultant output sent to the facility for the generation of air traffic situation displays which are transmitted to a research aircraft. E.A.K.

**N82-14076#** Federal Aviation Administration, Atlantic City, N.J.
**IN-SERVICE TESTING OF THE PRECISION APPROACH PATH INDICATOR (PAPI) AT NEWARK INTERNATIONAL AIRPORT, NEW JERSEY Interim Report, Dec. 8, 1980 - Apr. 8, 1981**
Bret B. Castle Dec. 1981 11 p
(DOT-081-502-510)
(DOT/FAA/RD-81/95; DOT/FAA/CT-81/79) Avail: NTIS HC A02/MF A01

The Precision Approach Path Indicator (PAPI) tests involving four months of inservice testing at Newark International Airport, New Jersey are presented. Basically, the PAPI was compared against the standard red/white Visual Approach Slope Indicator (VASI) system at a large airport and on a runway with an Instrument Landing System (ILS). The PAPI system was installed in a manner to take care of aircraft of all sizes; that is, different wheel to eye distances. Information was obtained from pilots of large commercial aircraft. Results show that under these conditions about 60 percent of the pilots prefer the PAPI over the VASI system. S.L.

**N82-14077*#** Ohio Univ., Athens. Avionics Engineering Center.
**COMMUTATED AUTOMATIC GAIN CONTROL SYSTEM**
Stephen R. Yost [1981] 25 p refs
(Grant NGR-36-009-017)
(NASA-CR-164798; TM-81) Avail: NTIS HC A02/MF A01 CSCL 17G

A commutated automatic gain control system (AGC) was designed and constructed for the prototype Loran C receiver. The AGC is designed to improve the signal-to-signal ratio of the received Loran signals. The AGC design does not require any analog to digital conversion and it utilizes commonly available components. The AGC consists of: (1) a circuit which samples the peak of the envelope of the Loran signal to obtain an AGC voltage for each of three Loran stations, (2) a dc gain circuit to control the overall gain of the AGC system, and (3) an AGC amplification of the input RF signal. The performance of the AGC system was observed in bench and flight tests; it has improved the overall accuracy of the receiver. Improvements in the accuracy of the time difference calculations to within approx. + or - 1.5 microseconds of the observed time differnces for a given position are reported. N.W.

**N82-14078*#** Ohio Univ., Athens. Avionics Engineering Center.
**A PROTOTYPE INTERFACE UNIT FOR MICROPROCESSOR BASED LORAN-C RECEIVER**
Stanley M. Novacki, III Nov. 1981 11 p refs
(Grant NGR-36-009-017)
(NASA-CR-164887; TM-82-NASA) Avail: NTIS HC A02/MF A01 CSCL 17G

An inexpensive data/command entry and CRT display system capable of alphanumeric and graphics moe operation and designed to operate in place of a separate ASCII terminal, is documented. The software to interface this unit to the 6502-based Loran C receiver is also described. The system simplifies receiver operations to a level typical of current avionics systems. N.W.

**N82-14079#** Mitre Corp., McLean, Va.
**REQUIREMENTS FOR INSTRUMENT APPROACHES TO TRIPLE PARALLEL RUNWAYS**
T. N. Shimi, W. J. Swedish, and L. C. Newman Jul. 1981 148 p refs
(Contract DTFA01-81-C-10001)
(AD-A105622; MTR-81W145; FAA-EM-81-12) Avail: NTIS HC A07/MF A01 CSCL 01/2

Current ATC procedures do not consider instrument approaches to more than two parallel runways. This document discusses the engineering results of an analysis that examined the technical feasibility of conducting triple parallel instrument approaches as a means of increasing the aircraft flow at congested airports. The technical criteria that were subjected to analysis include the physical characteristics of the airfield, airspace and aircraft mix, surveillance (the radar and display systems), and control (procedures for normal and abnormal operations. The expected performance in safety and capacity was estimated for alternative landing concepts. An analysis was conducted of blunders and evasion strategies. It was found that, for a given configuration, a single blunder recovery strategy could be specified that would produce acceptable separations between aircraft. Missed approaches on triple parallels and pilot acceptance of triple approaches are also discussed. Lastly, recommended requirements and control procedures for triple parallel instrument approaches are presented. Author (GRA)

**N82-14080#** Mitre Corp., McLean, Va.
**REQUIREMENTS FOR INDEPENDENT AND DEPENDENT PARALLEL INSTRUMENT APPROACHES AT REDUCED RUNWAY SPACING**
A. L. Haines and W. J. Swedish Washington FAA May 1981 182 p refs
(Contract DTFA01-81-C-10001)
(AD-A105673; MTR-81W15; FAA-EM-81-8) Avail: NTIS HC A09/MF A01 CSCL 01/2

Independent parallel instrument approaches are conducted today only if the runway centerlines are 4300 ft apart or more. The rationale behind this criterion is reviewed, and the requirements for reducing the criterion to 3000 ft are evaluated. Although some benefit is derived from improvements in navigational accuracy, the performance of the surveillance system has the greatest impact on the required runway spacing. Dependent alternating instrument approaches to parallel runways are also evaluated. Currently such approaches require a runway spacing of 3000 ft or more. The effects of reducing this runway spacing are discussed, especially with regard to blunder recovery. Reducing the runway spacing required for these approaches could increase the arrival capacity and reduce delays at certain airports and would provide increased flexibility for planning new runways. Author (GRA)

**N82-14081#** Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
**FEASIBILITY STUDY FOR AN ADVANCED LIGHTED AID TO NAVIGATION Final Report**
Stephen Jaskulek, Eric J. Hoffman, and Walter E. Allen Sep. 1981 121 p refs
(Contract N00024-81-C-5301)
(AD-A105944; USCG-D-48-81) Avail: NTIS HC A06/MF A01 CSCL 17/7

This report discusses a Coast Guard advanced aid to navigation network. Various light sources, positioning systems, and radio links are investigated for suitability to solar powered marine aids. A modular microprocessor-based aid, capable of self diagnostic monitoring and differential Loran-C positioning, is described. A communication system between the aids and shore stations, using conventional or meteor burst VHF or a GOES satellite link, is examined, showing the first and last options to be most viable. Inter-aid flash synchronization schemes, and data transmission formats, polling methods, and system performance analysis are discussed. Having established the technical feasibility of the advanced aid concept, cost and reliability estimates are performed on the proposed systems. Finally, recommendations on areas requiring further study are presented. Author (GRA)

# 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

**N82-14082#** Kaman Aerospace Corp., Bloomfield, Conn.
**ADVANCED TECHNOLOGY LIGHTWEIGHT GONDOLA SYSTEM EXPERIMENTAL FABRICATION PROGRAM Final Report, Aug. 1979 - Mar. 1981**
John D. Porterfield Jul. 1981 133 p refs
(Contract DAAK51-79-C-0036; DA Proj. 1L1-62209-AH-76)
(AD-A104157; R-1630; USAAVRADCOM-TR-81-D-24) Avail: NTIS HC A07/MF A01 CSCL 01/3

Design concept verification hardware for the helicopter external gondola systems (HEGS) 10 and 20 modules, critical element and component fabrication and testing and full-scale HEGS 20 gondola assemblies were accomplished. The HEGS 20 module characteristics demonstrated during design, fabrication, and testing included (1) structural efficiency (2) impact resistance potential, (3) producibility, (4) repairability without post heat treatment, (5) maintenance, (6) functional and structural capabilities, (7) load and unload capabilities, (8) cargo tie-down capabilities, (9) compatibility with automated lifting devices and ground transport equipment, (10) suitability for loading and unloading on uneven terrain, and (11) low weight potential.
Author

**N82-14083#** Army Armament Research and Development Command, Watervliet, N. Y. Geotechnical Lab.
**C-5A OPERATIONAL UTILITY EVALUATION SOIL TESTS AND ANALYSIS Final Report, Jun. - Aug. 1980**
Robert W. Grau Aug. 1981 74 p refs
(Contract MIPR-F7B13001430001)
(AD-A105555; WES-TR-GL-81-7) Avail: NTIS HC A04/MF A01 CSCL 08/13

The purpose of this report is to present the data collected concerning the ground flotation characteristics of the C-5A aircraft during the C-5A operational utility evaluation test program. This report gives a description of the three test sites selected for this program, a summary of all soil and surface distress measurements taken at each site during aircraft operations, and an analysis of the data. Results of this evaluation test program indicate that 3-in. ruts have little or no effect on the performance of the C-5A aircraft on unsurfaced areas. Author (GRA)

**N82-14084#** National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
**A METHOD FOR MEASURING TAKEOFF AND LANDING PERFORMANCE OF AIRCRAFT, USING AN INERTIAL SENSING SYSTEM**
A. Pool, J. L. Simons, G. J. H. Wensink, and A. J. L. Willekens 25 Sep. 1980 10 p refs Presented at AGARD Flight Mech. Panel Symp. on Subsystem Testing and Flight Test Instrumentation, Geilo, Norway, 27-30 Oct. 1980
(NLR-MP-80036-U) Avail: NTIS HC A02/MF A01

An inertial sensing system, STALINS, used to provide trajectory data for takeoff and landing measurement instrument design, is presented. The system specifications based on certification requirements for civil transport aircraft are defined for continuous and rejected takeoff, minimum unstick speed, minimum control speed on the ground, and landing. Calculations are performed using a computer program supplemented by a manual check, giving horizontal distance and height measurements. Data are made available within 24 hours. The method is accurate and is suitable for tests at several airfields, since instrumentation is either onboard already, or easily transported by the aircraft. Author (ESA)

# 06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

**N82-14085*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**A GENERAL AVIATION SIMULATOR EVALUATION OF A RATE-ENHANCED INSTRUMENT LANDING SYSTEM DISPLAY**
David A. Hinton Dec. 1981 44 p
(NASA-TP-1960; L-13911) Avail: NTIS HC A03/MF A01 CSCL 01D

A piloted-simulation study was conducted to evaluate the effect on instrument landing system tracking performance of integrating localizer-error rate with raw localizer and glide-slope error. The display was named the pseudocommand tracking indicator (PCTI) because it provides an indication of the change of heading required to track the localizer center line. Eight instrument-rated pilots each flew five instrument approaches with the PCTI and five instrument approaches with a conventional course deviation indicator. The results show good overall pilot acceptance of the display, a significant improvement in localizer tracking error, and no significant changes in glide-slope tracking error or pilot workload. B.W.

**N82-14086** Royal Aircraft Establishment, Farnborough (England).
**A TRUE AIR SPEED SENSOR FOR MINIATURE UNMANNED AIRCRAFT**
J. A. C. Beattie Jun. 1981 11 p refs
(RAE-TM-SPACE-287; BR80019) Copyright. Avail: Issuing Activity

A prototype sensor with digital output is described. Vortex shedding principles are exploited by using a bluff body with end-plates to produce a stable set of vortices alternately from the edges of the body. Vortex production frequency is directly proportional to the speed of the fluid past the body. A pair of printed thick film thermistors detect the vortices. Tests show excellent linearity of response, although sensor geometry, and signal processing electronics can be improved. Author (ESA)

**N82-14087#** General Electric Co., Cincinnati, Ohio. Aircraft Equipment Div.
**ELECTRONIC MASTER MONITOR AND ADVISORY DISPLAY SYSTEM, OPERATIONAL FUCTIONS REPORT Interim Report, Jun. 1979 - Oct. 1980**
Oct. 1980 201 p refs
(Contract DAAK80-79-C-0270; DA Proj. 1L2-62202-AH-85)
(AD-A105516; ACS-12-217; AVRADCOM-TR-79-0270-2; IR-2) Avail: NTIS HC A10/MF A01 CSCL 01/3

Basic system operating requirements for an Electronic Master Monitor and Advisory Display System (EMMADS), developed for use on U.S. Army helicopters to reduce crew workload by assuming responsibility for tasks associated with subsystem status monitoring, are described. A baseline for defining the requirements of the feasibility demonstration hardware is provided EMMADS functions described include examples related to the CH-47C helicopter, the aircraft selected as the basis for the EMMADS feasibility model. Author

**N82-14088#** Naval Air Development Center, Warminster, Pa.
**INVESTIGATION OF FUNCTIONAL COMMONALITY OF AVIONICS SYSTEMS IN NAVAL AIRCRAFT Final Report, Jan. - Sep. 1981**
John M. Cunningham 30 Sep. 1981 136 p refs
(W05720000)
(AD-A105503; NADC-81235-20) Avail: NTIS HC A07/MF A01 CSCL 09/3

This report presents the results of a study to determine general requirements for the development of core avionics equipment for common usage by Naval aircraft. The study addresses the core avionics architecture and the relationship between existing core avionics equipment and advanced subsystems under development. The report provides specific recommendations regarding: procurement policies; the application

of standards to electronic interfaces; and the development of the basic architectural components. GRA

**N82-14089#** Southwest Research Inst., San Antonio, Tex.
**HELICOPTER MODEL STUDIES FOR ON-BOARD ELECTROSTATIC SENSORS Final Report, 25 Sep. 1979 - 24 Jan. 1981**
O. Tranbarger, B. M. Duff, and T. R. Owen Fort Eustis, Va. Army Research and Technology Labs. Sep. 1981 286 p refs (Contract DAAK51-79-C-0060; DA Proj. 1L1-62209-AH-76) (AD-A105511; SWRI-14-5863; USAAVRADCOM-TR-81-D-26) Avail: NTIS HC A13/MF A01 CSCL 13/12

Hovering helicopters accumulate excessive charge as a result of triboelectrification, surrounding space charge, and external electric fields that result in high electrostatic potentials on the aircraft. Electrostatic energy stored on the helicopter can cause electrical discharges to occur from the cargo hook when contact is made with the ground or ground personnel. Laboratory model studies were conducted under electrostatic conditions simulating hovering aircraft to show that on-board instrumentation capable of measuring electric field intensity and charge density can provide the basis for indirectly inferring the correct potential relative to ground of a spherical model test body. Potential of the model was inferred for three cases involving electrostatic instrumentation located (1) on the ground below the model, (2) installed at the south pole of the model, and (3) mounted at the end of the simulated cargo hook. Analysis of laboratory test data resulted in empirical derivations of unique electric field curves for each of the three cases studied. The first two cases were also studied analytically by solving Poisson's equation for a sphere between two parallel plates, and the mathematical expressions substantiated the laboratory results. Methodology for developing a full-scale helicopter electrostatic discharger system to eliminate hazardous potentials on helicopter aircraft is described.
Author (GRA)

# 07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

**N82-14090*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**GAS TURBINE CERAMIC-COATED-VANE CONCEPT WITH CONVECTION-COOLED POROUS METAL CORE**
Albert F. Kascak (AVRADCOM Research and Technology Labs., Cleveland), Curt H. Liebert, Robert F. Handschuh, and Lawrence P. Ludwig Dec. 1981 14 p refs Sponsored in part by U.S. Army Aviation Research and Development Command, St. Louis (NASA-TP-1942; AVRADCOM-TR-81-C-7; E-732) Avail: NTIS HC A02/MF A01 CSCL 21E

Analysis and flow experiments on a ceramic-coated-porous-metal vane concept indicated the feasibility, from a heat transfer standpoint, of operating in a high-temperature (2500 F) gas turbine cascade facility. The heat transfer and pressure drop calculations provided a basis for selecting the ceramic layer thickness (to 0.08 in.), which was found to be the dominant factor in the overall heat transfer coefficient. Also an approximate analysis of the heat transfer in the vane trailing edge revealed that with trailing-edge ejection the ceramic thickness could be reduced to (0.01 in.) in this portion of the vane. B.W.

**N82-14091*#** National Aeronautics and Space Administration, Washington, D. C.
**WIND TUNNEL TESTS OF ENGINE-EQUIPPED MODELS: COMPARISON OF TWO JET WASH SIMULATION METHODS**
J. P. Becle and R. Perin Dec. 1981 43 p ref Transl. into ENGLISH of 'Essais en Soufflerie de Maquetter Motorisees. Comparison de Deux Methodes de Simulation des Jets des Reacteurs" rept. T.P. 1981-42, France, 1981 p 1-18 Presented at the AGARD/FDP Symp. Aerodynamics of Power Plant Installation, Toulouse, 11-14 May 1981 Original language document was announced as A81-39245 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by ONERA, Toulouse
(Contract NASw-3542)
(NASA-TM-76764; TP-1981-42) Avail: NTIS HC A03/MF A01 CSCL 21E

The optimization of performance factors in state of the art civil aircraft was studied by using powered models in wind tunnels. In cooperation with ONERA, two methods of cold simulation of jet engine washes were developed. The first, called 'blown jet', benefitted from the previously perfected test set-ups made for studies of the CONCORDE. The second, which utilized small air-turbines, were recently put into operation for the AIRBUS family of aircraft. The facilities, the measurement equipment and the methods of exploiting the results are described. The relative value of each of the methods of motorization is analyzed: complexity of equipment, duration, precision of measurements and comparison of results are also discussed. A.R.H.

**N82-14092*#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
**CORE COMPRESSOR EXIT STAGE STUDY. VOLUME 4: DATA AND PERFORMANCE REPORT FOR THE BEST STAGE CONFIGURATION Final Report**
D. C. Wisler Apr. 1981 204 p refs
(Contract NAS3-20070)
(NASA-CR-165357; R80AEG314-Vol-4) Avail: NTIS HC A10/MF A01 CSCL 21E

The core compressor exit stage study program develops rear stage blading designs that have lower losses in their endwall boundary layer regions. The test data and performance results for the best stage configuration consisting of Rotor-B running with Stator-B are described. The technical approach in this efficiency improvement program utilizes a low speed research compressor. Tests were conducted in two ways: (1) to use four identical stages of blading to obtain test data in a true multistage environment and (2) to use a single stage of blading to compare with the multistage test results. The effects of increased rotor tip clearances and circumferential groove casing treatment are evaluated. E.A.K.

**N82-14093*#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.
**CORE COMPRESSOR EXIT STAGE STUDY. VOLUME 5: DESIGN AND PERFORMANCE REPORT FOR THE ROTOR C/STATOR B CONFIGURATION**
D. C. Wisler May 1981 101 p refs
(Contract NAS3-20070)
(NASA-CR-165358; R81AEG287-Vol-5) Avail: NTIS HC A06/MF A01 CSCL 21E

Rear stage blading designs that have lower losses in their endwall boundary layer regions were developed. The design of rotor-C and the performance results for rotor-C running with stator B are described. A low speed research compressor is utilized as the principal investigative tool. Four identical stages of blading are used to obtained data in a true multistage environment. E.A.K.

**N82-14094*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**THE USE OF OPTIMIZATION TECHNIQUES TO DESIGN CONTROLLED DIFFUSION COMPRESSOR BLADING**
Nelson L. Sanger 1982 18 p refs Proposed for presentation at the 27th Ann. Intern. Gas Turbine Conf., London, Apr. 18-22, 1982; sponsored by ASME
(NASA-TM-82763; E-1084) Avail: NTIS HC A02/MF A01 CSCL 21E

A method for automating compressor blade design using numerical optimization, and applied to the design of a controlled diffusion stator blade row is presented. A general purpose optimization procedure is employed, based on conjugate directions for locally unconstrained problems and on feasible directions for locally constrained problems. Coupled to the optimizer is an analysis package consisting of three analysis programs which calculate blade geometry, inviscid flow, and blade surface boundary

layers. The optimizing concepts and selection of design objective and constraints are described. The procedure for automating the design of a two dimensional blade section is discussed, and design results are presented. E.A.K.

**N82-14095*#** AiResearch Mfg. Co., Phoenix, Ariz.
**POLLUTION REDUCTION TECHNOLOGY PROGRAM SMALL JET AIRCRAFT ENGINES, PHASE 3 Final Report**
T. W. Bruce, F. G. Davis, T. E. Kuhn, and H. C. Mongia Dec. 1981 180 p refs
(Contract NAS3-20819)
(NASA-CR-165386; AiResearch-21-3615) Avail: NTIS HC A09/MF A01 CSCL 21E

A series of Model TFE731-2 engine tests were conducted with the Concept 2 variable geometry airblast fuel injector combustion system installed. The engine was tested to: (1) establish the emission levels over the selected points which comprise the Environmental Protection Agency Landing-Takeoff Cycle; (2) determine engine performance with the combustion system; and (3) evaulate the engine acceleration/deceleration characteristics. The hydrocarbon (HC), carbon monoxide (CO), and smoke goals were met. Oxides of nitrogen (NOx) were above the goal for the same configuration that met the other pollutant goals. The engine and combustor performance, as well as acceleration/deceleration characteristics, were acceptable. The Concept 3 staged combustor system was refined from earlier phase development and subjected to further rig refinement testing. The concept met all of the emissions goals. E.A.K.

**N82-14096*#** AiResearch Mfg. Co., Phoenix, Ariz.
**ERBS FUEL ADDENDUM: POLLUTION REDUCTION TECHNOLOGY PROGRAM SMALL JET AIRCRAFT ENGINES, PHASE 3 Final Report**
T. W. Bruce, F. G. Davis, T. E. Kuhn, and H. C. Mongia [1982] 47 p refs
(Contract NAS3-20819)
(NASA-CR-165387; AiResearch-21-3619) Avail: NTIS HC A03/MF A01 CSCL 21E

A Model TFE731-2 engine with a low emission, variable geometry combustion system was tested to compare the effects of operating the engine on Commercial Jet-A aviation turbine fuel and experimental referee broad specification (ERBS) fuels. Low power emission levels were essentially identical while the high power NOx emission indexes were approximately 15% lower with the EBRS fuel. The exhaust smoke number was approximately 50% higher with ERBS at the takeoff thrust setting; however, both values were still below the EPA limit of 40 for the Model TFE731 engine. Primary zone liner wall temperature ran an average of 25 K higher with ERBS fuel than with Jet-A. The possible adoption of broadened proprties fuels for gas turbine applications is suggested. E.A.K.

**N82-14097#** Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
**OPTIMIZATION OF COMPRESSOR VANE AND BLEED SETTINGS Final Report, May 1979 - May 1981**
J. E. Garberoglio, J. O. Song, and W. L. Boudreaux Wright-Patterson AFB, Ohio AFWAL Jun. 1981 83 p refs
(Contract F33615-79-C-2018; AF Proj. 2307)
(AD-A106059; PWA-FR-14487; AFWAL-TR-81-2046) Avail: NTIS HC A05/MF A01 CSCL 21/5

This report evaluates optimization methods for their effectiveness in relating multistage axial compressor test data to the decision to vary a selected vane or bleed to reach a predetermined performance goal. Compressor simulations were used in a comparative evaluation and each method was judged on the basis of the number of tests required to achieve an optimum performance goal. The influence of measurement errors and finite vane travel were also prime considerations. Based on this evaluation, the COPES/CONMIN approximate optimization technique was chosen most suitable. Author (GRA)

**N82-14098#** Naval Postgraduate School, Monterey, Calif.
**FOREIGN OBJECT DAMAGE IN NAVAL AIRCRAFT ENGINES M.S. Thesis**
Jack B. Mills Jun. 1981 138 p refs
(AD-A105787) Avail: NTIS HC A07/MF A01 CSCL 01/3

An investigation of historical data was conducted in an attempt to assign a specific cause to each foreign object damage incident reported during an eighteen month period. Interviews were conducted with engineers and fleet maintenance personnel in support of the above research. The impact of current FOD reporting procedures, the foreign objects, the ingestion process and the operating environment are discussed. Conclusions and recommendations are included. Author (GRA)

**N82-14099#** Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
**CORROSION INHIBITING ENGINE OILS Final Interim Report, 4 Sep. 1979 - 1 Dec. 1980**
G. C. Brown, R. J. Meehan, and P. A. Warner Wright-Patterson AFB, Ohio AFWAL Aug. 1981 73 p refs
(Contract F33615-79-C-5089)
(AD-A106127; PWA-FR-13908; AFWAL-TR-81-4028) Avail: NTIS HC A04/MF A01 CSCL 11/8

The Fluids, Lubricants, and Elastomers Branch of the Materials Laboratory, AFWAL, established the requirements for a MIL-L-7808H operational oil with corrosion inhibition characteristics at least equal to those of MIL-C-8188C. The new oil formulation is to provide corrosion inhibition under long-term storage conditions of the ALCM F107 turbine engine. During the initial fifteen-month effort, several approaches were evaluated as candidate methods for determining the effectiveness of corrosion inhibiting oil additives. A screening procedure was developed after preliminary modifications were made to the Corrosion Rate Evaluation Procedure (CREP). Using the CREP together with compatibility and miscibility screening of oil/inhibitor blends, a total of 67 candidate corrosion inhibitors (CCI) were evaluated. These included CCI obtained from Bray Oil Company, El Monte, California, as part of a subcontract to synthesize candidate corrosion inhibitors. Additional tests were completed on a preliminary physical and chemical property evaluation of the oil/inhibitor blends in regard to MIL-L-7808H and MIL-C-8188C specifications. GRA

**N82-14100#** Technische Hochschule, Darmstadt (West Germany). Inst. fuer Werkstoffunde.
**LONG-TERM STABILITY OF FINELY CAST ALLOYS FOR GAS TURBINE BLADES UNDER HOT GAS CORROSION CONDITIONS [ZEITSTANDFESTIGKEIT VON FEINGUSSLEGIERUNGEN FUER GAS TURBINENSCHAUFELN]**
K. H. Kloos, J. Granacher, and H. Denus 1980 25 p refs In GERMAN Presented at European Symp. on the Interaction between Corrosion and Mech. Stress at High Temp., Petten, Netherlands, 13-14 May 1980 Sponsored by Bundesministerium fuer Forschung und Technologie
(DECHEMA-Proj-4.2/1; DECHEMA-Proj-4.2/1F) Avail: NTIS HC A02/MF A01

Two hot gas corrosion conditions were tested: mild for aircraft and industrial turbines, and hard (by adding seasalt or S, Na, Va and Cl) for aircraft and industrial gas turbine composite materials. The longest loading times obtained before rupture are about 2000 hr at 700C and about 5000 hr at 800C. The probes were microscopically investigated after the tests. No reduction of the long-term stability due to hot gas corrosion is found as compared to the case of air at rest. Author (ESA)

# 08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

**N82-14101*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**MLS VERTICAL GUIDANCE AND NAVIGATION FOR A STOL AIRPLANE LANDING ON AN ELEVATED STOLPORT**
David N. Warner, Jr. Nov. 1981 27 p refs
(NASA-TM-81338) Avail: NTIS HC A03/MF A01 CSCL 01C

In contrast to CTOL landing operations, STOL airplanes landing on short STOLport runways typically begin the flare maneuver before reaching the runway surface. Vertical guidance procedures

were developed to allow an autoland flight control system for a STOL airplane to use Microwave Landing System (MLS) signals as altitude and sink rate references for flare initiation, with a transition to radar altimeter after the airplane is over the runway. The implementation has minimum impact on the control system and landing performance. Data are presented which show validation of the concepts in a simulator. Author

# 09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

**N82-14102** Royal Aircraft Establishment, Farnborough (England).
**THE DESIGN OF A JET CATCHER**
K. G. Winter and L. F. East Feb. 1981 11 p refs
(RAE-TM-AERO-1891; BR78582) Copyright. Avail: Issuing Activity

A device for catching and dissipating the kinetic energy of a jet used in a boundary layer tunnel to eliminate unwanted air currents is described. A dished front face and a large outlet catch the jet, avoiding spillage, and pass it through a screen set normal to the flow in order to reduce kinetic energy. The screen is inclined so as to take advantage of refraction. An additional muslin screen reduces noise. Final outlet velocity is 1/8 of the jet velocity, although there is slight spillage.
Author (ESA)

**N82-14103** Royal Aircraft Establishment, Farnborough (England).
**AN AFTERBODY DRAG BALANCE**
A. G. Kurn Mar. 1981 12 p ref
(RAE-TM-AERO-1897; BR78346) Copyright. Avail: Issuing Activity

A strain gage drag balance was made to fit into the jet blowing rig in a transonic wind tunnel. Differences in the drag of various axisymmetric boattailed afterbodies surrounding an engine exhaust nozzle were determined. Three sets of four flexures are spaced equally along the x axis, with strain gages on the middle set. The gages on the center flexures form bridges, compensated for thermal induced drift. Calibration shows that signals are linear with drag force. Output signals can be monitored from two separate strain gage circuits. The device can withstand components of force and moment that might be applied during model assembly. Drag values up to 20N can be measured. Author (ESA)

**N82-14104#** Grumman Aerospace Corp., Bethpage, N.Y.
**STUDY OF FIBER OPTICS TO ENHANCE AN ENVIRONMENTAL LIGHTING LABORATORY Final Report, Nov. 1979 - Mar. 1981**
J. Connelly Wright-Patterson AFB, Ohio AFWAL Aug. 1981 154 p Prepared in cooperation with Galileo Electro-Optics Corp., Strubridge, Mass.
(Contract F33615-79-C-3629; AF Proj. 2403)
(AD-A106117; AFWAL-TR-81-3098) Avail: NTIS HC A08/MF A01 CSCL 13/1

This report documents the results of an investigation to determine how fiber optic materials can be utilized to substantially increase the simulation capabilities of an Environmental Lighting Laboratory. This Laboratory must provide the capability to dynamically simulate the ambient environmental illumination conditions encountered in day, night and high threat/high risk aircraft missions. Three cockpit lighting simulator concepts were studied. Two of these concepts utilized a spherical lighting enclosure with a visual scene being projected at the inner surface via a remote projection input surface; fiber optics carry the image from input surface to output surface. In one concept, the pilot views a back-projected image on a translucent spherical screen via a spherical output surface with imbedded fiber optics. In the other concept, the pilot views the spherical fiber optic output surface directly. Both concepts were considered possible to implement; each concept having appropriate cost vs. performance tradeoffs. No useful solution was found using the third concept, a fiber optic input to mirrored ellipsoidal enclosure. It was found that the spherical enclosure concept with an internal translucent projection screen offers the best combination of illumination level and resolution; however, the cost of implementing this concept is substantial. GRA

**N82-14105#** Test Group (6585th), Holloman AFB, N. Mexico
**RAIL ROUGHNESS STUDY OF THE HOLLOMAN HIGH SPEED ROCKET SLED TEST TRACK Final Report, May 1978 - Jun. 1981**
Larry C. Mixon, Charles B. Evans, and Windell L. Gilliam 1 Sep. 1981 97 p refs
(AF Proj. 9993)
(AD-A105778; AD-TR-81-62) Avail: NTIS HC A05/MF A01 CSCL 14/2

Data from a first order survey of the Holloman High Speed Rocket Sled Test Track was statistically analyzed to characterize the roughness of the rails. The rail roughness is a forcing function manifested as vibration in high speed sled tests conducted on the Track. Statistical methods in the space and frequency domain were developed and discussed and further data requirements were justified. Author (GRA)

**N82-14394#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**RESEARCH ON AN INDUCTION DRIVEN CRYOGENIC WIND TUNNEL**
Alain Blanchard, Jean-Bernard Dor, Andre Mignosi, and Jean-Francois Breil *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 63-77 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

# 12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

**N82-14106*#** Texas Southern Univ., Houston.
**INTRODUCTION TO ORBITAL FLIGHT PLANNING (1)**
H. E. Blackwell, ed., Eugene L. Davis, and Della D. Dell 31 Aug. 1981 140 p refs
(Grant NAG9-6)
(NASA-CR-165052) Avail: NTIS HC A07/MF A01 CSCL 22A

This workbook is designed for students interested in space flight planning, who after training, may serve as flight planning aides. Routine flight planning activities requiring engineering-type calculations and analysis are covered. Practice exercises and brief instructions are given for the programming and use of the hand calculator as well as the calculation of position and velocity in the orbital plane. Calculation of relative orbital position is also covered with emphasis upon celestial coordinates and time measurement. R.J.F.

**N82-14107#** European Space Agency, Paris (France).
**SCIENTIFIC AND EXPERIMENTAL ASPECTS OF THE GIOTTO MISSION**
B. Battrick, comp. and J. Mort, comp. Jun. 1981 154 p refs Proceedings of Intern. Meeting, Noordwijkerhout, Netherlands, 27-28 Apr. 1981
(ESA-SP-169; ISSN-0379-6566) Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

A flyby mission to Halley's comet is discussed, and various experiments and sensors are described. Investigations center on solar wind/comet interaction, cometary dust, composition of the cometary atmosphere, and the comet nucleus. For individual titles, see N82-14108 through N82-14122.

**N82-14108#** European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.

**GIOTTO: A MISSION TO HALLEY'S COMET**

R. Reinhard *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p ix-xix refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

The ESA Giotto mission, a fast flyby of Halley's Comet in March 1986, is described. In situ measurements in the cometary atmosphere are planned to unravel the complex physical and chemical processes that occur in it, to provide the elemental and isotopic composition of the volatile components and dust, to investigate the solar wind/comet interaction, and to image the nucleus which is too small to be seen from Earth. Giotto is a spin stabilized spacecraft based on a GEOS design. Its main features include a dual sheet bumper shield to protect it from dust particle impacts in the innermost part of the coma and a high gain, despun antenna dish allowing high data rate transmission at 40 kbit/sec over a distance of 1 AU. The encounter in the comet environment only lasts 4 hours due to the high flyby velocity of 68 km/sec. Giotto is targeted on the comet nucleus or slightly sunward of it, the miss distance being on the order of 500 km. Together with the Soviet Venera and the Japanese Planet A missions to Halley, the Giotto in situ measurements are the first on any comet. Author (ESA)

**N82-14109#** Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Astrophysik.

**PLASMA FLOW AND MAGNETIC FIELDS IN COMETS**

**c91**

H. U. Schmidt and R. Wegmann *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 3-7 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

Plasma flow and field amplification, resulting from the interaction of the solar wind with a comet, are studied by model calculations for the rates G = 7 X 10 to the 26 power to 2 X 10 to the 30 power of total cometary gas production. The influence of the magnetic field is investigated, using an axisymmetric model. A three-dimensional magnetohydrodynamic calculation shows how the magnetic field induces an asymmetry. A sudden change of direction in the interplanetary field produces streamer-like structures. Author (ESA)

**N82-14110#** Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.

**THE GIOTTO MAGNETOMETER EXPERIMENT**

F. M. Neubauer *In* ESA Sci. and Exptl. Effects of the Giotto Mission Jun. 1981 p 9-15 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

The Giotto magnetometer experiment for triaxial measurement of the magnetic vector field during and before the Halley encounter in March 1986 is described. In situ observations of the magnetic fields associated with the comet/solar wind interaction, including a variety of macroscopic and microscopic plasma phenomena, and a careful search for nucleus related magnetic field signatures are planned. The instrumentation, designed for minimum mass, consists of a triaxial ring-core fluxgate magnetometer sensor system mounted on the antenna mast, the magnetometer analog electronics, and a minimum digital processor inside the spacecraft proper. The experiment has a total mass of 1.5 kg and power consumption of 1.2 W. The measuring ranges per component are given. The 12 bit analog to digital conversion together with some overhead provide 40 bits per vector and a total bitrate of 1200 bit/sec. Author (ESA)

**N82-14111#** University Coll., London (England). Mullard Space Science Lab.

**A COMETARY PLASMA EXPERIMENT FOR THE MISSION TO HALLEY'S COMET**

A. Johnstone, D. Bryant (Space Research Council, Chilton, Engl.), T. Edwards (Space Research Council, Chilton, Engl.), B. Hultquist (Kiruna Geophysical Inst., Sweden), V. Formisano (ESTEC, Noordwijk, Netherlands), L. Biermann (Max-Planck Inst. fuer Physik und Astrophysik), R. Luest (Max-Planck Inst. fuer Physik und Astrophysik), H. Schmidt (Max-Planck Inst. fuer Physik und Astrophysik), W. Feldman (Los Alamos Scientific Labs), P. Cerulli-Irelli (Ist. Plasma Spaziale) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 17-27 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

The cometary plasma experiment measures the three dimensional velocity distribution of positive ions in the energy range 10 eV to 70 keV, separating the masses into six major groups. The instrument package includes a fast ion sensor to measure the energy distribution from 10 eV to 20 keV in all directions except the cone around the velocity vector once every rotation of the spacecraft without mass discrimination. An implanted ion sensor is also provided to measure the energy distribution from 100 eV to 70 keV over a 140 deg range of polar angle, with mass discrimination. Author (ESA)

**N82-14112#** Toulouse Univ. (France).

**THE COPERNIC EXPERIMENT TO MEASURE THREE DIMENSIONAL ELECTRON DISTRIBUTION AND THE COMPOSITION OF THERMAL POSITIVE IONS INCLUDING WATER CLUSTERS NEAR HALLEY'S COMET**

H. Reme, F. Cotin, C. Duston, J. A. Sauvard, A. Korth (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), A. K. Richter (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), K. A. Anderson (California Univ., Berkeley), C. W. Carlson (California Univ., Berkeley), R. P. Lin (California Univ., Berkeley), A. Wekhof (California Univ., Berkeley) et al *In* ESA Sci. and Exptl. Effects of the Giotto Mission Jun. 1981 p 29-37 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

An experiment was designed to measure three-dimensional electron energy distribution from < 10 eV to 30 keV as well as the composition and distribution of thermal positive ions, with mass discrimination, including clathrate hydrates in the range 10 to < 230 amu is described. The data obtained can help in determining: (1) the nature of comet tails and the comet/solar wind interaction; (2) the chemical and physical nature of the comet atmosphere and ionosphere and (3) the chemical and physical structure of the comet nucleus. Symmetric quadrispherical electrostatic analyzer provides three-dimensional electron measurements with high sensitivity and high energy, angular, and time resolution. A light electrostatic mass analyzer detects thermal positive ions with high sensitivity, low background and good mass resolution close to the comet. The two instruments have open, flythrough apertures. Author (ESA)

**N82-14113#** Saint Patrick's Coll., Maynooth (Ireland).

**AN ENERGETIC PARTICLE DETECTOR FOR GIOTTO AND ITS SCIENTIFIC OBJECTIVES**

S. McKenna-Lawlor, A. Thompson (Dublin Inst. for Advanced Studies), D. OSullivan (Dublin Inst. for Advanced Studies), E. Kirsch (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), D. B. Helrose (Sydney Univ.), and K.-P. Wenzel (ESTEC, Noordwijk, Netherlands) *In* ESA Sci. and Exptl. Aspects for the Giotto Mission Jun. 1981 p 39-44 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

Active and passive background shielding is provided for an energetic particle detector designed to observe energetic particles in the cometary atmosphere as well as monitor the presence of energetic solar particle fluxes. During the encounter phase, spectrum and angulr information concerning particle fluxes are provided with a time resolution of 1 sec. During the cruise phase, 1 hr average particle flux measurements are made in all channels. Sectoring of the measurement of one proton channel (0.1 to 2.1 MeV) is also planned. One hour average solar particle flux measurements together with angular information in the 0.1 to 2.1 MeV proton channel acquired during cruise, when combined with simultaneous observations made by other spacecraft located at different heliographic longitudes, provide information concerning solar particle propagation in the corona and in interplanetary space. Author (ESA)

**N82-14114#** Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).

**SIZE DISTRIBUTION, STRUCTURE, AND CHEMICAL COMPOSITION OF COMETARY DUST PARTICLES** **c91**

Hugo Fechtig *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 47-52 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

Observations of cometary dust are reviewed, both for Earthbound measurements and for space measurements. The structure of cometary dust is of low density, such as the loosely conglomerated fluffy particles collected in the atmosphere by Brownlee. Reported IR measurements show silicates to be the main constituent of cometary dust. From simulation experiments and theoretical considerations, more primitive material than previously assumed in the form of carbonaceous C 1 chondrites should be expected. The submicron sized grains may be at least partly of presolar or interstellar origin. The strongest criteria are isotopic deviations from the solar system values, for example for C12/C13 and/or Li7/Li6. Author (ESA)

**N82-14115#** Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).

**THE PARTICULATE IMPACT ANALYZER, AN INSTRUMENT TO ANALYZE SMALL PARTICLES RELEASED BY HALLEY'S COMET** **c19**

J. Kissel *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 53-60 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

The particulate impact analyzer, which is to provide time of flight mass spectra of individual dust particles released by Halley's Comet and the average composition and mass distribution of cometary matter, is described. The instrument is a redesign of the dust experiment flown on Helios 1 and 2, using commercial instrument developments (mass resolution m/Delta m = 200). It has a sensitivity as to measured particles from 3 x 10 to the minus 16 power to 5 x 10 to the minus 10 power g (0.1 to 10 microns diameter) with impact rates up to 100/sec. Depending on cometary activity, data on some 1000 to 50,000 cometary particles should be obtained. Author (ESA)

**N82-14116#** Kent Univ., Canterbury (England). Space Sciences Lab.

**A DUST IMPACT DETECTION SYSTEM FOR THE GIOTTO HALLEY MISSION** **c19**

J. A. M. McDonnell, E. Gruen (Max-Planck Inst. fuer Kernphysik), G. C. Evans, J. G. Firth (Science Research Council, Chilton, Engl.), W. C. Carey, H. Kuczera (Technische Univ., Munich), W. M. Alexander (Baylor Univ., Waco, Tex.), D. H. Clark (Sciene Research Council, Chilton, Engl.), R. J. L. Grard (ESTEC, Noordwijk, Netherlands), M. S. Hanner (JPL, Pasadena, Calif.) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 61-75 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

A detection system which registers impacts from all significant masses of particles incident on the probe during the post perihelion encounter with Halley's Comet in 1986 is described. Instrumentation comprises three separate subsystems; an impact plasma and momentum sensor (IPM), a meteoroid shield momentum sensor (MSM), and a meteoroid shield penetration sensor which is an additional channel of the MSM system. The IPM sensor is a very high sensitivity impact plasma detector which measures the simultaneous positive and negative signals caused by a charge separation of the plasma in a lateral electric field. The MSM system deploys three 200 kHz resonant piezoelectric crystals on the periphery of the meteoroid shield, yielding a sensor area of 1.94 sq m. From the amplitude of the signals from the sensors both the impact position and impact momentum can be deduced. The system is controlled and data processed by a microprocessor yielding flexible formatting for information on the 100, 000 separate events to be transmitted during the brief encounter period. Author (ESA)

**N82-14117#** Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).

**DYNAMICS AND CHEMISTRY OF COMETARY COMAS: A PRE-GIOTTO VIEW** **c91**

W.-H. Ip *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 79-91 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

Present understanding and basic questions of cometary coma chemistry and dynamics are reviewed. Comet-solar wind interaction, the particle-and-field environment of a cometary coma, and the chemical composition for both neutral particles and ions in different regions of a coma are discussed, stressing how the Giotto mission can contribute to elucidating these phenomena. Cometary models are postulated and expected results from Giotto measurements on Halley's Comet are mentioned. Author (ESA)

**N82-14118#** Bern Univ. (Switzerland). Physikalisches Inst.

**THE GIOTTO ION MASS SPECTROMETER** **c19**

H. Balsiger, J. Geiss, D. T. Young, H. Rosenbauer (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), R. Schwenn (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), W.-H. Ip (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), E. Ungstrup (Danish Space Research Inst.), M. Neugbauer (JPL, Pasadena, Calif.), R. Goldstein (JPL, Pasadena, Calif.), B. E. Goldstein (JPL, Pasadena, Calif.) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 93-98 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

An ion mass spectrometer for the Giotto mission is proposed. A wide range of ion species and velocity distributions are expected to be found in the interaction between solar wind and cometary plasmas. The resultant demands on instrument dynamic range preclude use of a single sensor for measurements of ion composition. The Giotto ion mass spectrometer consists of two sensors: one optimized for the outer and the other for the inner coma, with each obtaining complementary information in the region for which it is less than optimal. Both sensors have mass resolution m/Delta m = 20 and use two-dimensional detector arrays to improve time resolution. Considerable onboard data compression is used to reduce the four-dimensional measurements (mass, energy, elevation and azimuth) to the available data rate. Author (ESA)

**N82-14119*#** Smithsonian Astrophysical Observatory, Cambridge, Mass.

**NOTES ON THE P/HALLEY NUCLEUS** **c91**

Fred L. Whipple *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 101-103 refs (For primary document see N82-14107 05-12)

(Grant NsG-7082)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

Indirect evidence and theory concerning the nucleus of P/Halley are summarized. Reasonable estimates place its diameter in the range 2.5 to 4.0 km, but the true value may well lie outside these bounds. The observed activity in its inner coma indicates that the nucleus is spotty and contains small activity areas as do other similar comets. Whether these active areas will show as dark or light regions on the nucleus is not known. Jets of dust will probably obscure parts of the nucleus when imaged by a nearby spacecraft. Author (ESA)

**N82-14120#** Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).

**A HALLEY MULTICOLOR CAMERA** **c35**

H. U. Keller, C. Arpigny (Liege Univ.), C. Barbieri (Padua Univ.), P. Benvenuti (Padua Univ.), L. Biermann (Max-Planck Inst. fuer Physik und Astrophysik, Munich), R. M. Bonnet (CNRS, Verrieres-le-Buisson, France), S. Cazes (CNRS, Verrieres-le-Buisson, France), G. Colombo (Padua Univ.), C. B. Cosmovici (DFVLR, Oberpfaffenhofen, West Germany), W. A. Delamere (Ball Aerospace Systems Div., Boulder, Colorado) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 105-117 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

A multicolor camera is proposed which would provide high quality images of the nucleus (in four colors) and of the coma (in several filter bands) of Halley's Comet. With this experiment, the nuclear size, shape and albedo are measured while the active sublimation process of the nucleus is observed. Determination of the chemical composition (albedo variation and wavelength dependence) of the nucleus is assisted, and insight into the energy balance on the surface is gained. Observations of the inner coma provide details of the interaction of the sublimating gas with the surface and dust. A major part of the encounter is devoted to coma (gas and dust) observations in ten different wavelength (color) bands. The microcomputer of the Halley multicolor camera can also determine the trajectory parameters of the spacecraft relative to the nucleus in real time.

Author (ESA)

**N82-14121#** Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.

**THE HALLEY OPTICAL PROBE EXPERIMENT** **c19**

A.-C. Levasseur-Regourd, J. L. Weinberg (Lab. d'Astronomie, Marseille), F. Giovane (Lab. d'Astronomie, Marseille), D. W. Schuermann (Lab. d'Astronomie, Marseille), P. Lamy (Space Astronomy Lab., Gainesville, Florida), M. Festou (Space Astronomy Lab., Gainesville, Florida), J. L. Bertaux, R. Dumont, A. Llebaria, and R. H. Giese *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 121-126 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

The concept of the optical probe is presented; it is based on photopolarimetric measurements made parallel to the direction of motion through gas and dust coma. The measurements optically characterize the interior of the coma and provide in situ information on optical properties of the grains. They also determine spatial variations of the number densities, changes in the grains size distribution and ratio of gaseous emission/dust scattering as a function of probe position. The spectral photopolarimeter to be used is described. Since all channels are analyzed by a multi-anode microchannel photomultiplier and since polarization is determined through the spacecraft rotation, the instrument is extremely simple, light, and reliable.

Author (ESA)

**N82-14122#** Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).

**THE GIOTTO NEUTRAL MASS SPECTROMETER** **c19**

D. Krankowsky, P. Laemmerzahl, P. Eberhardt (Bern Univ.), U. Herrmann (Bern Univ.), J. J. Berthelier (CNRS, Paris), M. Sylvain (CNRS, Paris), J. H. Hoffman (Texas Univ., Dallas), R. R. Hodges (Texas Univ., Dallas), U. vonZahn (Bonn Univ.), H. U. Keller (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 127-130 refs (For primary document see N82-14107 05-12)

Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

The chemical nature of gases and ionized species in the coma are identified and their chemical and isotopic abundances and energy distributions measured using an instrument having two sensors. The E-analyzer is a parallel plate electrostatic analyzer, and the M-analyzer consists of a parallel plate electrostatic analyzer coupled with a magnetic analyzer in a double-focusing geometry. The M-analyzer provides mass identification even for particles that have kinetic energies up to 20 eV in the comet frame. The E-analyzer determines the energy distribution of the constituents up to 2110 eV in the probe frame which for thermal species (200 K) also gives mass information, thus expanding the instrument mass range. As both the M and E-analyzer have focal plane detectors, the full mass-energy range is measured simultaneously without scanning, providing high sensitivity and a spatial resolution of about 100 km.

Author (ESA)

**N82-14123#** European Space Agency, Paris (France).

**SPACECRAFT FLIGHT DYNAMICS**

T. D. Guyenne, ed. and G. Levy, ed. Aug. 1981 503 p refs Partly in ENGLISH and FRENCH Proceedings of Intern. Symp., Darmstadt, West Germany, 18-22 May 1981 (ESA-SP-160; ISSN-039-6566) Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Analytical and computational methods used in ground-based control of satellites, software utilization, and the evaluation of satellite missions and their associated software are discussed. For individual titles, see N82-14124 through N82-14172.

**N82-14124#** Royal Aircraft Establishment, Farnborough (England).

**RESEARCH RESULTS FROM ANALYSIS OF SATELLITE ORBITS** **c13**

D. G. King-Hele *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 3-11 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The analysis of changes in satellite orbits caused by aerodynamic and gravitational forces as a tool to investigate the upper atmosphere and Earth gravitational field is assessed. While the technique is limited, being incapable of measuring rapid changes density or distinguishing between species of gases, it remains the best way of tracing long term variations in air density, particularly semiannual variations and changes during a solar cycle. Other uses include the provision of scale height for atmospheric models, information on rotation rate of the upper atmosphere, evaluation of zonal harmonics for gravitation studies, and lumped harmonic values for gravity field models.

Author (ESA)

**N82-14125#** European Space Operations Center, Darmstadt (West Germany).

**A SIRIO 2 LASER RANGING EXPERIMENT** **c19**

J. M. Dow and W. Flury *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 13-23 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The use of tracking data from the SIRIO 2 Laser Synchronization from Stationary Orbit experiment for high precision determination of a geostationary orbit is proposed. Data of decimeter or subdecimeter accuracy collected for the basic mission can be used to investigate polar motion to determine gravity coefficients for ionospheric calibration for precise orbit determination comparison with radio tracking and to calibrate the VHF ranging network used for ESA geostationary missions. Additional ranging operations to supplement routine VHF checks are needed.

Author (ESA)

**N82-14126#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.

**ACCURATE ORBIT DETERMINATIONS FROM LASER RANGE OBSERVATIONS BY LAGEOS, STARLETTE AND GEOS 3** **c13**

K. F. Wakker and B. A. C. Ambrosius *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 25-35 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The effect on orbit calculation of the spatial, temporal and geographical distribution of laser data and of different perturbation models was investigated. Selected data arcs of geodetic satellites were analyzed. The data were used to determine simultaneously for the orbit the coordinates of two laser stations and the effect of atmospheric drag and gravity field models on orbit determination. The positional accuracy of the LAGEOS, Starlette, and GEOS 3 satellites is evaluated. Truncating the GEM 9 gravitational field model up to order and degree 13, yields position differences of $< 15$ cm for LAGEOS while GEM 103 gives position differences $< 1$m along track. For GEOS 3 and Starlette, position differences of of 4.5 m radial and 17 m along track are shown between the two models. Atmospheric drag modeling for GEOS 3 shows an along track position error of 30 m for an arc in which a geomagnetic storm occurred.

Author (ESA)

**N82-14127#** European Space Operations Center, Darmstadt (West Germany).

**LUNAR GRAVITATIONAL FIELD DETERMINATION** c91
W. Flury *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 37-45 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and No (+20% others)

Lunar gravitational field determination is reviewed and the Polar Orbiting Lunar Observatory gravity experiment is discussed. The mission baseline comprises two spacecraft; the Orbiter in a low altitude near circular polar orbit and the Relay in a high altitude trajectory. The two spacecraft allow Doppler tracking on the lunar farside (via Relay) and improve coverage in the polar regions. Covariance analysis shows that processing of Relay Doppler data permits an order of magnitude improvement in the precision of the polar moment of inertia parameter. Daily tracking sessions of 2 hours over 27 days are required. Doppler data accurate from 1 to 2 mm/sec is essential. Author (ESA)

**N82-14128#** Pisa Univ. (Italy). Gruppo di Meccanica Spaziale.
**MODELING OF ORBITAL PERTURBATIONS DUE TO RADIATION PRESSURE FOR HIGH EARTH SATELLITES** c13
L. Anselmo, P. Farinella, A. Milani, and A. M. Nobili *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 47-52 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

By general perturbations techniques, the orbital effects of radiation pressure in the semimajor axis and in longitude are computed and divided into long and short periodic ones. Long periodic effects are excluded for constant attitude spacecraft. Even for satellites with an Earth pointing antenna, for low inclination and eccentricity and for good antenna pointing, long periodic perturbations in the semimajor axis are small. However, there are longitude perturbations of secular character. The perturbations on the orbit of the SIRIO 2 satellite are computed as an example. An accurate orbit determination is possible for high, e.g., geosynchronous, satellites if orbit and attitude are carefully chosen. Author (ESA)

**N82-14129#** European Space Operations Center, Darmstadt (West Germany).
**SPACECRAFT FLIGHT DYNAMICS AT ESOC** c18
R. E. Muench *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 55-60 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The characteristics and applications of mathematical tools used by the European Space Operations Center (ESOC) for mission planning and support are outlined, including estimation methods, optimization methods; modeling (dynamics, control devices, and space environment sensors), and computer systems. Computer software used in mission planning and spacecraft evaluation is described. Support tasks are characterized as development, planning, evaluation, and consultancy. Author (ESA)

**N82-14130#** Aerospace Corp., El Segundo, Calif.
**NAVSTAR GLOBAL POSITIONING SYSTEM (GPS): FUTURE ENHANCED CAPABILITIES** c17
Mohan Ananda *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 61-71 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Aspects of GPS research are reviewed. Navigation using radio interferometric techniques, analyses leading to more accurate orbit prediction of GPS satellites, and high precision application of GPS beyond the current 16 m spherical error probability capability are discussed. Improved ground systems are advocated in order to fully exploit the radio interferometric technique. User system signal processing and data processing capabilities for high precision applications, are needed. Author (ESA)

**N82-14131#** Centre National d'Etudes Spatiales, Toulouse (France).
**OPERATIONAL LOADS INDUCED BY ORBITAL CONTROL OF A GEOSTATIONARY SATELLITE [LES CHARGES OPERATIONNELLES INDUITES PAR LE CONTROLE EN ORBITE D'UN SATELLITE GEOSTATIONNAIRE]** c15
G. Cales *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 73-80 refs In FRENCH (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The ground control structures needed for a geostationary satellite are discussed. Standardization of equipment and software used in centers; use of job specific techniques, e.g., computers (since they are easy to use and involve less time and installation costs than more powerful, multipurpose techniques); and geographical centralization which facilitates information exchange, reduces equipment expenses, and creates a readily available multidisiplinary research team are discussed. Author (ESA)

**N82-14132#** Amsat-Deutschland e.V., Marburg (West Germany).
**THE ATTITUDE CONTROL SYSTEM OF AMSAT P 3 SATELLITES** c15
Karl Meinzer *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 81-84 ref (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A system which uses an onboard 16 k byte computer to control attitude using magnetic torque and sensor data is described. Sun data is collected by crossed slit sensors. A Sun crossing time reference (signal/satellite revolution) controls a phase locked loop dividing the spin rotation into time increments. Earth sensors are pencil beam, visible light sensors 3 deg above and below the satellite equatorial plane. The computer uses Earth based, orbit based, and spacecraft spin based coordinates. Accuracy depends on sensor performance. Even with 2 deg error it is sufficient for amateur radio communication. Author (ESA)

**N82-14133#** European Space Operations Center, Darmstadt (West Germany).
**IRREGULARITIES IN THE MOTION OF SPIN STABILIZED EARTH SATELLITES** c15
L. Fraiture, N. Wiengarn, and B. Chambaz (Applications Mathematiques et Logiciel, SARL) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 87-104 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Changes in spin rate of rigid spacecraft caused by slowly moving internal parts which are periodic with the orbital period and secular spin up are analyzed using data from the radiometer of METEOSAT 1, ESRO 4, and GEOS 2. A hierarchy of relative spin variations, i.e., near Earth orbital missions with eclipse thruster leakage, thermal yearly geostationary missions, and diurnal albedo geostationary missions are shown. For missions where exact spin rate and its control are important, in-flight calibration is recommended as these are difficult to predict, especially the leaking thruster effect. Author (ESA)

**N82-14134*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**HIGH PRECISION ATTITUDE DETERMINATION FOR MAGSAT** c15
G. Abshire, R. McCutcheon, G. Summers, F. VanLandingham, and G. Meyers *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 105-116 refs Prepared in cooperation with Computer Science Corp., Silver Spring, Md. (For primary document see N82-14123 05-12)
(Contract NAS-5-24300)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22A

A two phase approach to attitude determination software development is introduced. The prelaunch planning and software activities connected with the development and testing of the baseline system for processing nominal attitude data for MAGSAT are described and postlaunch analysis and modifications are outlined. Attitude data processing began 5 months after launch so that postlaunch anomalies could be accounted for. Another advantage of the two phase approach is that costs are reduced because the system is not burdened with software dealing with all possible contingencies. A definitive, continuous, time history of the three axis attitude of the spacecraft was generated to a precision of 20 arc sec (one standard deviation), in each axis. Sensor alignment determinations were done continuously

because of the deletrious effects of changing alignments on attitude precision. Author (ESA)

**N82-14135#** National Aerospace Lab., Amsterdam (Netherlands).
**ESTIMATES OF SPACECRAFT ATTITUDE AND SENSOR PARAMETERS USING ADAPTIVE FILTERING: METEOSAT 1 TRANSFER ORBIT APPLICATION** **c18**
G. Moek and C. R. Traas (Technische Hogeschool, Twente, Netherlands) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 117-131 refs (For primary document see N82-14123 05-12)
(Contract ESTEC-3319/77)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

An adaptive filtering technique which resolves filter divergence problems caused by modeling errors was developed and applied to Meteosat 1. Adaptation is applied with an intensity governed directly by the intensity of the divergence detected. Delays of IR Earth sensors spacecraft attitude were estimated. Combinations of Sun aspect angle, Earth chord, and midscan rotation angle measurements were used. Results for spacecraft attitude and Earth sensor delays are accurate to within 3 to 4 standard deviations and suggest that modeling errors are due to simple modeling of spacecraft dynamics and sensors which does not allow accurate evaluation of updated measurements.
Author (ESA)

**N82-14136*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena. Navigation Systems Section.
**DEEP SPACE NAVIGATION SYSTEMS AND OPERATIONS** **c17**
James F. Jordan *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 135-150 refs (For primary document see N82-14123 05-12)
(Contract NAS-7-100)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22A

The history of the deep space navigation system developed by NASA is outlined. Its application to Mariner, Viking and Pioneer missions is reviewed. Voyager navigation results for Jupiter and Saturn are commented on and velocity correction in relation to fuel expenditure and computer time are discussed. The navigation requirements of the Gahleo and Venus orbiting imaging radar (VOIR) missions are assessed. The measurement and data processing systems are described. Author (ESA)

**N82-14137#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**GEOSTATIONARY SATELLITES LAUNCHED BY NASDA. PART 1: NASDA TRACKING AND CONTROL SYSTEM** **c15**
T. Takenouchi and M. Suzuki *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 151-155 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Software used by the National Space Development Agency (NASDA) of Japan is described. The telemetry and command processing (on-line) and housekeeping data processing; orbit determination, including tracking data preprocessing and orbital event prediction; attitude determination, including telemetry data preprocessing and sensor event prediction; maneuver planning and command generation, including apogee kick motor firing, station acquisition and keeping, and command evaluation and the mission analysis subsystems are discussed. The system operates on-line during the launch phase and off-line during the stationary phase. The system has proven reliable for all NASDA missions. Author (ESA)

**N82-14138#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**GEOSTATIONARY SATELLITES LAUNCHED BY NASDA. PART 2: MISSION ANALYSIS FOR MANEUVER** **c15**
A. Tanaka, M. Utashima, K. Inamiya (Mitsubishi Electric Corp.), T. Ogino (Mitsubishi Electric Corp.), and T. Shimizu (Fujitsu Ltd.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 157-166 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Analyses, operational criteria and emergency operations related to the attitude and maneuvering orbit control for Japanese geostationary satellites from injection into transfer orbit to the final station are provided. The maneuver mission analysis defines base lines for preparation of maneuver task flow, judging criteria, and emergency counter plan. Sequential task flows and judging criteria are necessary for actual maneuver planning, preparations of commanding, monitoring and evaluation in order to prevent confusion and wrong operations on actual missions. These are prepared considering not only the nominal case but also off nominal missions including emergency. The topical maneuver data of actual operation on geostationary satellites are shown.
Author (ESA)

**N82-14139#** British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
**L-SAT STATIONKEEPING** **c17**
J. J. Pocha and A. F. Edwards *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 165-182 (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The stationkeeping strategy for L-SAT is derived. The orbit perturbations that must be counteracted arise not only from natural sources such as triaxiality, solar radiation pressure, and lunisolar gravitation, but also from the spacecraft attitude control system operating in its normal and stationkeeping modes. The strategy is designed to allow for worst case conditions on a statistical basis and includes the effects of tracking and maneuver implementation errors. It provides for stationkeeping within the specified deadband with an optimum use of propellant.
Author (ESA)

**N82-14140#** European Space Operations Center, Darmstadt (West Germany).
**THE USEFULNESS OF AUXILIARY TRANSFER ORBIT MANEUVERS FOR A NEAR NOMINAL GEOSTATIONARY MISSION** **c13**
F. Hechler, M. Rosengren, and M. Soop *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 183-187 (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The usefullness of apogee and perigee raising maneuvers during transfer orbit operations in correcting errors due to launcher performance is illustrated. Maneuvers suggested are at perigee to raise the apogee and improve fuel usage, at apogee to raise the perigee in order to both improve fuel usage and decrease air drag, and between perigee and apogee to raise the perigee and reduce air drag. Depending on the amount of fuel available, these maneuvers can save a mission if hydrazine burns after apogee boost firing were used. Extra orbit burns can alleviate the risk of air drag damage to an anomalously low transfer orbit perigree. Author (ESA)

**N82-14141#** European Space Operations Center, Darmstadt (West Germany).
**MIDCOURSE NAVIGATION FOR THE EUROPEAN COMET HALLEY MISSION** **c17**
Martin Hechler and Freidrich Hechler *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 189-195 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Midcourse correction modes for the Giotto mission are analyzed and an onboard algorithm for propellant estimation is developed. Omnidirectional mode (turning the spacecraft spin axis in any direction for a low gain) cardoid, S band antenna combined mode (using a despun high gain antenna together with thermal and power conditions), and contingency modes used in case of thruster failure are used with axial continuous burn or radial pulsed burn. The use of these modes and propellant budgeting methods is investigated using the discretization method. Optimization is important for Giotto in case malfunctions in the initial stages prevent its close approach to the target.
Author (ESA)

**N82-14142#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany).

**STATION ACQUISITION AND STATIONKEEPING WITH LOW THRUST SYSTEMS** **c13**

M. Eckstein and F. Hechler (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 197-208 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Optimum control problems with low thrust station acquisition and stationkeeping during geostationary missions are linearized and solved by discretization of the thrust times and the thrust directions. This technique has considerable advantages in comparison to the classical methods, especially in the presence of constraints, on maneuver times and directions. A procedure applying the discretization method to a sequence of fuel-optimal minimum problems can be used to solve certain time minimum problems even in cases where classical methods fail. The rope stretching method is used to derive algorithms for the long-term strategy of correcting eccentricity perturbations. Examples of short-term and long-term optimal control problems associated with low thrust systems demonstrate the capacity of the methods. Author (ESA)

**N82-14143#** Columbia Univ., New York.

**AN INVESTIGATION OF THE ANOMALOUS ATTITUDE MOTION OF THE ISEE B SPACECRAFT** **c13**

Richard W. Longman and J. Andre Massart (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 211-224 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

An unexpected spin rate fluctuation of ISEE B is discussed. A temporary improvement achieved by attitude maneuvers only lasted 10 days. Since spin rate data do not show persistent decay, environmental sources of perturbation were studied. As apogee altitude excludes atmospheric drag and orbital eccentricity minimizes gravitational and magnetic field effects, solar influence was investigated. The equations of motion relevant to solar radiation pressure are derived. Although the numerical results are not conclusive, they suggest that solar radiation pressure alone is not sufficient to explain the spin ripple phenomenon. Analytical isolation of any steady oscillation or limit cycles is difficult because of the nonlinear nature of the excitation and the small amount of damping in the system. Author (ESA)

**N82-14144#** European Space Agency, Toulouse (France). Earth Observation Programme Office.

**A EUROPEAN FLIGHT DYNAMICS EXPERIMENT** **c15**

P. Boland *In its* Spacecraft Flight Dyn. Aug. 1981 p 225-232 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The interaction between spin velocity and torque produced by a thruster on the main body of Geos 1 parallel to the spin axis was investigated, using a model consisting of a rigid body and two hinged bars. This predicted that a maneuver involving a long, continuous burst of the thruster would result in a rapid reduction in spin velocity which would destabilize the spacecraft. Theoretical investigations confirm this and the maneuver was modified. An inflight test bears out the predictions, emphasizing the need for complete models of satellite dynamic behavior. Author (ESA)

**N82-14145#** Instituto de Pesquisas Espaciais, Sao Paulo (Brazil). Inst. de Pesquisas Espacias.

**OPTIMAL LINEAR ESTIMATION AND SUBOPTIMAL NUMERICAL SOLUTIONS OF DYNAMICAL SYSTEMS CONTROL PROBLEMS** **c63**

Atair Rios Neto and Luiz A. Waack Bambace *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 233-237 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A procedure which generates open loop suboptimal numerical solutions is proposed. The approximation of the control by a function dependent upon a finite number of parameters and the use of a linear perturbation scheme associated with a direct search criterion, reduce the problem to one of parameter optimization in each iteration. A stochastic approach to establish the search criterion and to treat the errors due to the first order approximation makes it possible to arrive at the search increment using optimal linear estimation. The procedure is applied to trajectory control and altitude maneuvers during transfer orbits. Author (ESA)

**N82-14146#** Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).

**LINEAR PROGRAMMING AND SUBOPTIMAL SOLUTIONS OF DYNAMICAL SYSTEMS CONTROL PROBLEMS** **c63**

Decio Castilho Ceballos and Atair Rios Neto *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 239-243 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Linear programming is used to obtain a direct search procedure for parameter optimization in the numerical solution of dynamical systems control problems, including those where state inequality constraints are present. The procedure applies to optimal control problems where the Rayleigh-Ritz method is used to obtain a suboptimal approximation, imposing a particular mathematical form on the control function, and making it dependent on a finite number of parameters. Due to its characteristic of reducing the problem in each iteration to one of optimization of a direct search increment vector of parameters, inherent plant parameters are easily treated. This characteristic implies having perturbations in the final states which explicity depend on the control parameters demonstrating that state inequality constraints can be included without the need of using penalty function methods. Author (ESA)

**N82-14147#** Universite Catholique de Louvain (Belgium).

**PARTITIONING METHODS FOR IDENTIFICATION AND CONTROL OF FLEXIBLE SPACECRAFT** **c18**

G. Campion and P. Y. Willems *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 245-251 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Results obtained in the estimation of the state vector and in the parameter identification of a linear model of Geos are presented. The sequential decision technique based on a binary quantization procedure is used. This method is tested with simulated data as well as with in-flight data provided by telemetry. Numerical results show good parameter identification, although when many have to be identified simultaneously, decision criteria must not be too severe. In-flight data from accelerometers are close to predicted values, but magnetometer data are available only for spin motion, so parameter identification is limited to preliminary steps. Author (ESA)

**N82-14148*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**FUTURE IN GROUND BASE ATTITUDE SUPPORT ACTIVITIES** **c14**

R. D. Werking and L. J. Happel (Old Dominion Systems Inc.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 255-262 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22D

The history of attitude support activities is traced. Support for a conventional mission and for the Solar Maximum Mission (SMM) are compared. The trend is towards more onboard data processing, with the ground computer playing a supportive, rather than governing role. This eliminates the need for large amounts of data transfer, enabling rapid delivery of ancillary data products. In SMM, attitude is included in the telemetry stream. The need for ground support is unlikely to diminish in the near future, since onboard computations still have to be checked. Author (ESA)

**N82-14149#** European Space Research and Technology Center, Noordwijk (Netherlands).

**ON SPIN MANEUVERS WITH A SYMMETRIC SATELLITE** **c15**

F. Janssens *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 263-268 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Formulas for calculating nonideal spin maneuvers with a symmetric satellite, e.g. Meteosat, are presented. These maneuvers generate a nutational motion and an attitude change. Self excited rigid body formulation was employed. The nutation is described by Fresnel integrals and formulas giving the maximum nutation and its rate of decrease are extracted. A closed form result for a small attitude change caused by a pure spin up thruster in the presence of initial nutation and by a general thruster on a Kovaleski top is quoted. Author (ESA)

**N82-14150#** National Aerospace Lab., Emmeloord (Netherlands).
**THE OBSERVATION PLANNING FACILITY FOR THE INFRARED ASTRONOMICAL SATELLITE (IFAS) c14**
E. Oord, P. J. dePagter, R. C. vanHoltz, and J. R. Mcdougall (Rutherford and Appleton Labs., Chilton, England) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 269-280 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The software that generates and schedules observations to enable IRAS to perform an all sky infrared survey and to observe other sources is described. The onboard computer consists of 2 processors, 64 K words of solid state memory and 2 455 Mbit taperecorders to allow the satellite to store an observations sequence, execute these in a time tagged manner, and store the resulting data. The planning facility correlates observation with other tasks, and provides human readable versions of observation programs. Although routine tasks are done automatically, manual intervention is possible. Author (ESA)

**N82-14151#** European Space Operations Center, Darmstadt (West Germany).
**SOFTWARE FOR THE RESCUE OF NONNOMINAL MISSIONS c61**
Guy Janin *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 281-283 ref (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Software system for mission planning of emergency situations occuring during partial mission failures are discussed. General mission analysis software which can be quickly adapted to an unexpected situation is required. A skeleton program, corresponding to the most general task and consisting of a succession of calls to subroutines, is designed. A collection of functional modules are stored in a library for use along with dummies to fill in the program. Standard algorithms are used, decided by the function rather than give the mathematical aspect preeminence. This approach is useful for orbit computation since it allows quick verification of orbital stability, eclipse times, visibility from ground stations, and other mission constraints for the proposed orbit, if an emergency arises during a mission. Author (ESA)

**N82-14152*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PRESENT STATUS AND FUTURE TRENDS IN NEAR-EARTH SATELLITE ORBIT DETERMINATION c13**
A. J. Fuchs *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 287-292 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22A

The major components of an orbit determination system and the evolution of the elements making up each component are reviewed. Typical accuracies presently achievable in the orbit determination process, the factors limiting the accuracies, and improvements in the dynamic models used in the process are summarized. Models are developed for orbit determination programs which include: (1) time varying area for solar radiation pressure; (2) a time varying model for albedo radiation pressure; (3) Earth tides which account for the distortions in the Earth's body due to Sun and Moon attraction; and (4) ocean tides which affect satellite altimeter data. Author (ESA)

**N82-14153#** European Space Operations Center, Darmstadt (West Germany).
**A SIMPLE APPROACH TO SOLVE THE METEOSAT IMAGE DEFORMATION PROBLEM BASED ON HORIZON EXTRACTION FROM IMAGE DATA AND ORBIT INFORMATION c74**
T. Wolff *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 293-298 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A method which determines in a restitution mode Meteosat image deformations of an image taken under nominal conditions is proposed. An iterative procedure for refined determination of the attitude derived from northern and southern polar horizon scan limits extracted from infrared image data is employed to be known with sufficient accuracy. The model can be applied, accurately using a pocket calculator, at any point of the Earth and no numerical problems are involved. The model is much faster than its predecessors, with only the inclusion of automatic landmark registration needing a lot of computer time.
Author (ESA)

**N82-14154#** Analytical and Computational Mathematics, Zurich (Switzerland).
**AN ANALYTICAL SINGULARITY-FREE ORBIT PREDICTOR FOR NEAR-EARTH SATELLITES c13**
G. Scheifele *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 299-305 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A completely analytical, first order satellite theory intended for low Earth orbits is presented. Perturbations are unified under the nonsingular Poincare Similar element formulation. The theory includes: short period, long period and secular effects of J2 and all higher zonal harmonics; secular and quadratic effects of atmospheric drag; and the average mean motion considering all harmonics of the geopotential. Recursive equations are used instead of explicit formulas. In the drag theory, the density model accounts for not only changes in altitude, but also the important effects of the Sun and its location. The theory is implemented in an operational computer program. Author (ESA)

**N82-14155#** Chinese Academy of Sciences, Peking. Space Science and Technology Center.
**ASPECTS IN MEASURING AND CORRECTING OF SATELLITE ORBIT c13**
Liu Zhong-yu and Gao Huai-bao *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 307-309 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris F 160 Member States, AU, CN and NO (+20% others)

Orbit calculation based on the initial ephemeris of the orbit along with the Doppler frequency data obtained from four ground stations, and a method for correcting the initial elliptical orbit using low thrust and short operation duration are discussed. Using the orbital differential correction method, more accurate orbit parameters are obtained. The orbit transfer and the control equations are derived. Numerical examples are presented. Attitude errors which occur during maneuvers are best corrected by manipulating yaw angle. Author (ESA)

**N82-14156#** Telespazio, S.p.A., Rome (Italy).
**SIRIO 2 LASSO MISSION: GEOSYNCHRONOUS SATELLITE LASER STATION RANGING DATA ORBIT DETERMINATION SIMULATIONS c13**
G. Vulpetti *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 313-323 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A predicted/updated estimation procedure, equivalent to Kalman filtering driven by white noise for the LASSO mission is presented. Analyzing the root-mean-squares of the cartesian components of the estimated error in position and velocity as a function of time and the number of observations, an almost steady state can be reached. In such environments, by processing periodical sets of some hundreds of 2 to 3 m noisy range values, precision one order of magnitude better than a VHF based estimation is achieved. It is suggested that precision can be further improved by adding astronomical angle data like azimuth and elevation. Author (ESA)

**N82-14157#** Indian Space Research Organization, Bangalore.
**ORBIT AND ATTITUDE DETERMINATION FOR BHASKARA c13**

R. S. Bhat, P. Rajendra Prased, N. Ramani, P. Padmanabhan, and K. Harendranath *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 325-332 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

An analytical orbit determination program is evaluated. During the early phase of the mission, satellite position was determined to an accuracy of 500 m, using interferometry data. An empirical method which uses times of closest approach data from a one way Doppler system reduces along track error to within 10 km is examined. Orbit decay is higher than predicted. The extended Kalman filter is used for attitude calculation data analysis, achieving 0.5 deg accuracy. It is concluded that a program which employs direct search, using simplexes, is more stable than an ordinary least square when data are limited.
Author (ESA)

**N82-14158#** Mathematischer Beratungs- und Programmierungsdienst G.m.b.H. Dortmund (West Germany).
**QUALITY CONTROL FOR MISSION-CRITICAL FLIGHT DYNAMIC OPERATIONS** **c38**
H. Mueller and R. E. Muench (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 333-340 ref (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20 % others)

Quality control requirements predominant for mission critical operations are illustrated by using Meteosat transfer orbits. Quality in flight dynamics is defined as numerical accuracy and stability, environment modeling accuracy, spacecraft subsystem compatibility, ability to cover non-nominal mission performances, and ability to cope with the environmental conditions. Mission critical operations emphasis is on: (1) software system consistency; (2) availability of tools and awareness of staff for the solving of unforeseen problems; and (3) compatibility between the mission timeline and flight dynamics operations. Author (ESA)

**N82-14159#** TRW Systems Group, Redondo Beach, Calif.
**GLOBAL GEOMETRY TECHNIQUES FOR MISSION ANALYSIS**
James R. Wertz *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 343-351 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A33/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The application of inertially fixed and spacecraft fixed global geometry plots to mission planning is discussed in relation to: (1) attitude determination and accuracy; (2) Sun, Moon and Earth interference; (3) eclipses; (4) tracking and data relay satellite system; and (5) launch windows. Spacecraft centered observations are used to obtain an understanding of spacecraft geometry which ensures that solutions to mission problems are based on engineering judgement rather than partial parametric studies, although these remain essential in the later stages. Global geometry techniques are faster and cheaper than parametric analysis. Author (ESA)

**N82-14160#** European Space Research and Technology Center, Noordwijk (Netherlands).
**THE DYNAMIC ATTITUDE RECONSTRUCTION METHOD** **c17**
A. G. Bird, L. Fraiture (ESOC, Darmstadt, West Germany), J. C. VanderHa (ESOC, Darmstadt, West Germany), and P. Kohler (Ecole Polytechnique Federale de Lausanne, Switzerland) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 353-360 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Operational software improvements to a method which uses information contained in the temporal evolution of the Earth colatitude and the Sun Earth azimuth angles, are described. The colatitudes and their derivatives are estimated by Kalman filter, using an observation model derived from a Kepler orbit. Three different attitude estimates follow directly from the Kalman estimates. A single attitude estimate is obtained by a weighted least squares combination of the Kalman filter outputs and the Sun measurements. In near colinearity of Sun and Earth vectors, the attitude estimate remains stable, whereas conventional methods diverge. Author (ESA)

**N82-14161#** National Aerospace Lab., Amsterdam (Netherlands).
**THE USE OF ESA STARMAPPER MEASUREMENTS FOR SPACECRAFT ESTIMATION: ESTIMATOR DESIGN RATIONALE AND RESULTS** **c13**
P. T. L. M. vanWoerkom, F. J. Sonnenschein, and G. Moek *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 361-372 refs (For primary document see N82-14123 05-12)
(Contracts ESTEC-2383/75/AK; ESTEC-3625/78/AK; ESOC-4133/79/D-IM)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Attitude estimation algorithms for processing starmapper data are outlined. The error in the averaged estimate is one arcminute. An operator which adjusts estimator tolerances and/or trigger levels is included. Measurements are taken over one nutation period, or less, on line estimation results are sufficient. The recursive processor uses the output from the batch processor as input. It uses a reduced sky model, monitors operation of the estimation process on line, introduces statistical adaptation when necessary, and produces more detailed information on the attitude motion of the spacecraft, misalignments of the starmapper, spacecraft mass redistribution, and external torques.
Author (ESA)

**N82-14162#** Indian Space Research Organization, Bangalore.
**VALIDATION AND OPERATIONS EXPERIENCE RELATED TO ORBIT AND ATTITUDE SOFTWARE OF BHASKARA** **c13**
K. S. Prabhu, S. K. Sinha, N. Ramani, C. Sreehari Rao (SHAR Centre, Sriharikota, India), and P. Soma (SHAR Centre, Sriharikota, India) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 375-383 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Software which meets a position accuracy requirement of + or - 4 km and attitude accuracy of + or - 3 deg for control purposes and better than 1 deg for post facto data processing was developed. An extended Kalman filter algorithm is used in near real time for attitude refinement. A geometrical method is used for initial estimation. A modified version which uses sensor and orbit data is used postfacto. Mission performance confirms predictions, even for unforeseen circumstances. The standard deviation in position determination is 500 m. Author (ESA)

**N82-14163#** European Space Operations Center, Darmstadt (West Germany).
**SPACECRAFT TRACKING CAMPAIGNS AND THE ASSESSMENT OF ORBIT DETERMINATION ACCURACY** **c17**
S. Pallaschke *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 385-395 (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Transfer orbit determination, based on VHF tracking and geosynchronous orbit determination with single station tracking are discussed. Analysis of VHF tracking of OTS 2 and VHF plus S band tracking of Meteosat shows that the ionospheric model performs well. A comparison test of S-band and VHF shows a difference of 200 m in semimajor axis, and an 8 km position difference. Single station tracking data for OTS shows good stability. More accurate calibration (detection of systematic offsets), by using radio stars, is needed to eliminate long-term variations. Author (ESA)

**N82-14164#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**OPTIMIZATION OF APOGEE KICK MOTOR (AKM) FIRING ATTITUDE** **c20**
M. Hirota, A. Tanaka, C. Abe (Fujitsu Ltd.), and T. Shimizu (Fujitsu Ltd.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 399-406 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Error propagation from the AMF parameters to the drift orbital elements is discussed. Geometrical solutions of the AMF attitude which give the typical drift orbits are presented. Optimum

AMF attitude is obtained by taking into account residuals of the AMF parameters: (1) increment velocity vector of AMF; (2) operational constraints for the stationing maneuvers; (3) effect of the attitude reorientation maneuver; and (4) post burn. Considering the effect of reorientation and post burn maneuvers, an iterative process calculates points on the error ellipsoid which give the maximum stationing fuels, and if the difference between these values is less than the tolerance the optimum point is reached. Author (ESA)

**N82-14165#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.

**EAST-WEST STATIONKEEPING MANEUVER c18**

M. Utashima, A. Tanaka, T. Tohchi (Fujitsu Ltd.), and T. Ogino (Mitsubishi Electric Corp.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 407-415 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Perturbations of a gestationary orbit and effects of an impulsive velocity increment were analyzed. Stationkeeping maneuvers based on a sun synchronized method (SSM) are evaluated for a communications satellite (CS). The SSM uses tangenital velocity impulses at the same time each day to correct drift. Maneuvers are performed every 21 days with a velocity increment of 0.1 m/sec, consuming 0.002 kg of hydrazine. The maneuvers lean towards the left due to the error in the semimajor axis resulting from orbit determination. These account for 50 m of the error. Author (ESA)

**N82-14166#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.

**INCLINATION CONTROL USING A PULSE MODE AXIAL THRUSTER c15**

M. Suzuki and K. Yoneyama *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 417-420 (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The use of a pulse mode axial thruster for inclination control of spin stabilized satellites is discussed. Computer simulations show that if attitude is controlled along the normal attitude plane an hour before crossing over the descending node, efficiency is reduced by 3% compared with control at the descending node, and by 10% at other times, so a control within one hour of descending node was used for in-flight tests. Attitude maneuvers were carried out in two stages to prevent Sun or Earth sensors losing their objectives during a long operation. Normal attitude was regained after further maneuvers. This method is longer than continuous mode thrusting but fuel consumption is similar. Author (ESA)

**N82-14167#** Centre National d'Etudes Spatiales, Toulouse (France).

**SKYLAB DECAY FOLLOW-UP c14**

J. P. Carrou *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 421-430 ref (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Skylab orbit decay and tracking procedures used for reentry predictions are described. Data from military and civilian radars were processed and used to compute a decay window which minimized risk to inhabited regions. Orbit control was achieved by modifying drag force to influence attitude. Semimajor axis drift was calculated and used to update predictions. The areas overflown during the final orbits were pinpointed 5 days previously. By reentry day it was possible to state that there was no danger of Skylab landing on France. Author (ESA)

**N82-14168*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**OPERATIONAL COMPENSATION FOR EFFECT OF CLOSE TITAN FLYBY ON REMAINDER OF VOYAGER 1 SATURN NEAR ENCOUNTER**

Richard P. Laeser *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 431-440 (For primary document see N82-14123 05-12) (Contract NAS7-100)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The satelite instrument pointing update process (SPUP) developed for the Voyager 1 Saturn encounter is assessed. At certain times, navigation errors translated into target pointing errors, impede camera operation. Two sigma pointing accuracy of 1.5 to 2.0 mrads per axis was required.The SPUP combines correction slews implemented by immediate action commands with preevent modifications. The process worked perfectly, producing good quality images of target areas. Author (ESA)

**N82-14169#** Science Research Council, Chilton (England). Rutherford and Appleton Labs.

**ACS PERFORMANCE VERTIFICATION FOR IRAS: SOFTWARE ENGINEERING AT THE OPERATIONS CONTROL CENTRE c61**

L. P. Baldwin *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 443-450 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The software engineering approach to support in orbit checkout, performance verification, and maintenance of the IRAS ACS are described. For in orbit checkout, a simple set of software is used to extract attitude related data from the observations required for the on-off calibration of the ACS units. During routine operations, however, a more complex set of software is used to perform an automatic analysis of attitude related data, extracted in general from the normal observing program, for regular monitoring of the various ACS performance characteristics. Testing shows adequate performance of individual units and the system as a whole. Author (ESA)

**N82-14170#** Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.

**IN ORBIT CHECKOUT OF THE IRAS GYROSCOPES c18**

J. F. M. vanCasteren *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 451-459 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The IRAS gyroscope package and factors which affect mission operations are described. The gyro sensor contains four gyros, one of which is redundant. A thermal control circuit and an optical cube to enable correct axes alignment at integration are included. For each satellite axis, one gyro controls and reconstructs attitude, making the gyro package a prime sensor for the mission. For control, the transfer function is assumed constant for 2 weeks. For reconstruction, a Kalman filter reestimates the transfer function parameters each second. The control and reconstruction accuracy of the primary observation modes, the survey scan, the low speed raster scan, and pointing are increased by calibrating the gyro transfer function at the applicable angular velocities about the input axis. Author (ESA)

**N82-14171#** Officine Galileo S.p.A., Florence (Italy).

**INFRARED RADIANCE MODEL VARIATION BY SENSOR FLIGHT MEASUREMENTS c43**

R. BaldassiniFontana, D. Sciacovelli (ESTEC, Noordwijk, Netherlands), and L. Fraiture (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 461-478 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The NASA and BAC-ESR 4 IR radiance models of Earth, applied to attitude sensor calibration, are compared. The sensors are IR pencil beams on spinning satellites. Flight measurements of Geos 2 and OTS transfer orbits were compared to simulations from a model which describes the optics, detector and electronics of the beam, based on directly measured parameters and laboratory test data. The models performed equally well. It is shown that anomalies in preflight calibration can be detected. A small mismatch of the optical axis inclination of a Geos 2 IR telescope was observed. Author (ESA)

**N82-14172#** Engins Matra, Velizy (France).

**THRUSTOR PERFORMANCE MODELING AND PARAMETERS ESTIMATION c20**

P. E. Bourg *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 479-484 refs (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The impact of temperature, pressure, and aging on thrustor behavior in pulsed and continuous burn modes was analyzed. Flight analysis of spin and three axis stabilized cases indicates maneuvers for which telemetered data allows identification algorithms to be applied: for three axis stabilized, nutation motion in normal operational mode and fixed momentum wheel unloading and for spin stabilized cases, spin axis reorientation and north south stationkeeping. Computer programs were checked on telemetry data and it is shown that it is not necessary to vary all control parameters to explain particular aspects of control loop behavior. Author (ESA)

**N82-14173#** European Space Agency, Paris (France).
**OTS: 3RD YEAR IN ORBIT**
Aug. 1981 222 p refs Presented at Intern. Conf. on Results of Tests and Expt. with the European OTS Satellite, London, 8-10 Apr. 1981
(ISBN-0-8529-6244-4; ISSN-0537-9989) Avail: NTIS HC A10/MF A01

The history and applications of OTS are discussed. Tests performed to aid in design of the European Communications Satellite, calibration, and performance tests, data transmission for both analog and digital television, use of ground station, and multiple access telephony systems are covered. For individual titles, see N82-14174 through N82-14198.

**N82-14174#** European Space Agency, Paris (France).
**PERFORMANCE OF THE ORBITAL TEST SATELLITE (OTS) DURING ITS THIRD YEAR OF OPERATION IN ORBIT** **c15**
*In its* OTS: 3rd Year in Orbit Aug. 1981 71 p (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Operation of the ESA geostationary telecommunication satellite, OTS, is assessed. The orbital test program is introduced. Spacecraft subsystems are described, including situation reports. Subsystems covered are: repeater, antenna, attitude and orbit control, power, and thermal control. Author (ESA)

**N82-14175#** Interim Eutelsat, Paris (France).
**OVERVIEW OF THE OTS EXPERIMENTAL PROGRAM**
P. Barthmann *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 7-11 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

The history of OTS and the establishment of the orbital test program (OTP) are outlined. The OTP consists of data transmission tests, i.e., telephony, propagation experiments, and television broadcasting. Various other tests, not falling within the original mission parameters, are also carried out, e.g., research into digital television. Author (ESA)

**N82-14176#** British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
**GENERAL DESCRIPTION OF THE ORBITAL TEST SATELLITE (OTS)** **c15**
D. E. McLaurin and D. N. Gregory *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 12-17 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

The OTS is a three axis stabilized vehicle designed for a minimum 5 year life in geosynchronous orbit with the individual satellite equipment designed for 7 year life operation. The modular approach adopted in the satellite design and in most equipment is identical to that used for the subsequent European Communications Satellite. The OTS consists of a service module providing all the basic service functions and a communication module carrying the payload. The configuration comprises two solar array paddles, each consisting of two hinged panels which are attached to the bearing and power transfer assemblies mounted on the north and south sides of the satellite being aligned along the satellite pitch axis. During launch and transfer orbit, the arrays are folded against the satellite sides so that half of their surface is exposed to provide power during this phase of the mission whereas in normal operation the arrays are deployed and steered to track the Sun. Author (ESA)

**N82-14177#** Telespazio, S.p.A., Rome (Italy).
**ATTENUATION STATISTICS OBTAINED WITH OTS** **c32**
P. Ferrazzoli, G. Brussaard (ESTEC, Noordwijk, Netherlands), L. Piccolomini, and A. Laloux (Univ. Catholique de Louvain, Belgium) *In* ESA OTS: 3rd Year in Orbits Aug. 1981 p 18-21 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Attenuation results in the form of single strong events and cumulative values are presented. In the 14 GHz uplink experiment 10 Earth stations transmitted two circularly polarized beacons each. One beacon, polarized in the same sense at the satellite receiving antenna, is used to measure attenuation. The other one transmits in the orthogonal polarization at a frequency 5 KHz higher than the corresponding beacon and is used to measure cross polarization. Single events considered include relationships between downlink beacon attenuation and radiometric attenuation, and attenuation between pairs of beacons. Large variations in results indicate that data from a longer timespan must be collected if useful conclusions are to be drawn. Author (ESA)

**N82-14178#** British Telecommunications Research, Ltd., Taplow (England).
**DEPOLARIZATION MEASUREMENTS AT 11 AND 14 GHz WITH OTS** **c32**
J. Thirlwell and N. J. McEwan *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 22-32 refs Prepared in cooperation with Bradford Univ., England (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

The OTS provides a linearly polarized beacon transmitted at 11.6 GHz and a circularly polarized one at 11.8 GHz. Cross-polar discrimination (XPD) is used as the measure of depolarization. A single event is used to illustrate effects. Methods of presenting joint XPD/attenuation statistics are shown. Linear polarization is superior to circular. Frequency scaling of XPD is assumed to follow theoretical predictions, but more data are needed. Wet snow on the ground station antenna produces XPD effects more severe than those of propagation effects. For scaling ice depolarization and XPD cumulation statistics, a modified scaling curve is suggested. Author (ESA)

**N82-14179#** Swedish Telecommunications Administration, Farsta.
**CORRELATING OTS BEACON MEASUREMENTS WITH RADIOMETER AND RAINFALL DATA** **c32**
Lennart Hansson *In* ESA OTS: 3rd year in Orbit Aug. 1981 p 33-36 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

The equivalent media temperature (EMT) used in radiometer attenuation evaluations is treated. Measured attenuation and rain rate statistical distributions are used to check an equivalent distance model. For EMT, rain attenuation was measured for two beacon frequencies, using beacon signals, and calculated from radiometer values of antenna noise temperature increase using a fixed EMT value of 270 K. Reliable data are obtained. The 5 year average statistical distribution of attenuation can be estimated to within 5% from the 5 year average rain rate distribution for any 5 year period using the same equivalent distance curve (obtained from floating 5 year average distributions over a 7 year period). The error is within 0.5 db, even at the 10 db level. Author (ESA)

**N82-14180#** Interim Eutelsat, Paris (France).
**IMPACT OF OTS PROPAGATION RESULTS ON THE ECS SYSTEM** **c32**
J. Dutronc and J. C. Raison *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 37-40 ref (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Fade and cross polarization results obtained from OTS are considered along with other propagation parameters (scintillation, atmospheric noise) in relation to the design of ECS. Results support the proposed design, but improvements are possible in polarization and frequency scaling of parameters, model for ice only crosspolar discrimination (XPD) statistics, and attenuation/XPD joint statistics. Further analysis is required, since results show large variations between ground stations. For a detailed

assessement of any given ECS link, a country by country scaling of statistics is needed. Author (ESA)

**N82-14181#** European Space Agency, Noordwikj (Netherlands).
**PLATFORM PERFORMANCE FACTORS AFFECTING LINK BUDGETS OF GEOSYNCHRONOUS COMMUNICATION SATELLITES c15**
L. vanHoltz and S. Fagg *In its* OTS: 3rd Year in Orbit Aug. 1981 p 41-47 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Problems of maintaining the communication antennas pointed accurately and controlling the orbit parameters so that movement relative to the Earth is minimized, are treated. The OTS is used to illustrate how natural forces tend to depoint the satellite and also disturb the otherwise perfect geostationary orbit. Experiments on OTS to reduce the latitude and longitude station-keeping deadband to + or - 0.035 deg are discussed. Attitude variations of as little as 0.05 deg can be observed in signal strength measured at the Earth stations. Monitoring these variations can be used when large maneuvers are to be conducted for purposes like changing coverage, or antenna pattern mapping. Author (ESA)

**N82-14182#** European Space Agency, Noordwikj (Netherlands).
**RESULTS OF TESTS ON THE SATELLITE SPOTBEAM ANTENNA c32**
N. Neale, P. Daly, and L. vanHoltz *In its* OTS: 3rd Year in Orbit Aug. 1981 p 48-52 ref (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Antenna performance was measured for OTS, using ground station recording of received signal levels while the satellite was allowed to swing to precise locations in a rectangular grid surrounding nominal beam center. Day/night beamswing caused by thermal stress was measured at night at 50 C, and by day at -140 C. Reliable antenna contours were produced within 24 hours of test completion. Beam movement of the spotbeam agrees with prelaunch predictions. Day/night gain variations can be directly related to received power flux density. Accuracy in determining beam center position is 0.1 deg absolute, with 0.04 deg repeatability. Author (ESA)

**N82-14183#** Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
**RESULTS AND CONCLUSIONS FROM THE RF CLASSICAL TRANSMISSION TESTS FROM THE POINT OF VIEW OF THE TELECOMMUNICATION AUTHORITIES c32**
H. Kleinschmidt, J. LeLigne (Centre National d'Etudes des Telecommunications), E. Saggese (Telespazio Spa), Y. Tharaud (Centre National d'Etudes des Telecommunications), and P. Tutton (British Telecom International) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 53-55 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Practicability and accuracy of verification tests of radio electrical characteristics of the complete link and the possibility of dividing ground station parameters from satellite parameters are discussed in relation to monitoring OTS. Test stations working in the 11/14 GHz bands, fully representative of future traffic stations for Eutelsat, performed tests on satellite parameters, including phase shift, cross polarization, gain, and amplitude/frequency characteristics. While key satellite parameters are measured with reasonable accuracy and repeatability, ground station parameters, e.g., antenna gain, must be more precisely calibrated. Author (ESA)

**N82-14184#** Filtronic Components Ltd., Leeds (England). ESA Communications Satellite Dept.
**RESULTS AND CONCLUSIONS OF RF PERFORMANCE TESTS MADE BY ESA c32**
C. D. Hughes and R. A. Gough *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 56-64 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Results of tests on OTS antennas (gain and gain stability of repeaters, payload, flux density, and amplitude/frequency response of repeaters) are discussed. Data were collected on an intensive basis during the first months postlaunch, followed by measurements at 6 month intervals. Results indicate that measurements possible with OTS, e.g., on antennas or flux, are not practical on commercial satellites because of damage risks and different ground support systems. On-line measurements are recommended to make satellites operational as quickly as possible. The test shows that OTS equipment is suitable for inclusion in the European Communications Satellite (ECS), although one antenna appears to have suffered mechanical damage and an amplifier failed after a few months. Author (ESA)

**N82-14185#** British Telecom International (England).
**RESULTS AND CONCLUSIONS OF THE 60 MBIT/SEC DIGITAL TRANSMISSION TESTS c32**
D. Prouse *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 65-68 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Results from breadboard models are compared with tests carried out by ground stations for OTS digital transmission. In-band impairment, interchannel interference, and noise interference were examined for their effect on bit error rate (BER). Results show good agreement between predictions and real data. Differences between given ground stations are attributed to individual demodulators responding in different ways to an impairment. Judged by the 60 Mbit/sec standard, the 40 MHz transponders of OTS perform well, although failure of the traveling wave tube amplifier in the transponder for the orthogonal polarization signal meant that investigations were limited to the uplink. Author (ESA)

**N82-14186#** Telespazio, S.p.A., Rome (Italy).
**RESULTS AND CONCLUSIONS OF THE 120 AND 180 MBIT/SEC DIGITAL TRANSMISSION TESTS c32**
A. Vernucci *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 69-73 Sponsored by Interim Eutelsat (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Single channel and cochannel interference tests were performed on the OTS transponders at 120 and 180 Mbits/sec in order to test their suitability for inclusion in the European Communications Satellite (ECS). Ground stations were used to check breadboard model predictions of systems performance. Although at 120, band-edge effects were not considered, and at 180, transponder amplitude was absent, results predict degradation at high data rates for ECS. Additional degradation is expected due to multipath and adjacent channel interference. More data is required, especially since a demodulator, which comes within specifications in the back to back mode, may have problems in the real environment. Other aspects, e.g. absolute encoding, burst to burst power variation, and the 40% cosine roll of filters, also require further investigation. Author (ESA)

**N82-14187#** European Space Agency, Paris (France). OTS-TDMA Experimenters Group.
**TDMA/DSI SYSTEM TESTS AND TELEPHONY CHANNEL TESTS VIA THE ORBITAL TEST SATELLITE (OTS) c32**
A. Bernard, T. Hentrich, H. Jack, A. Patacchini, D. Prouse, and N. Deacon *In its* OTS: 3rd Year in Orbit Aug. 1981 p 74-78 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Tests conducted at 120 Mbits/sec at 11/14 GHz are reported. Reference bursts were simulated by ground stations. Pseudorandom interference was added to the uplink and noise to the downlink, providing degraded link conditions. The OTS 120 MHz transponders which handle linear orthogonal polarized signal were used. System performance is good, with the synchronization accuracy of + or - 2 symbols attained even during highly degraded link conditions. Telephony channel results are incomplete due to equipment anomalies. Author (ESA)

**N82-14188#** British Telecom International (England).
**RESULTS AND CONCLUSIONS FROM TELEPHONE SIGNALING TESTS THROUGH TDMA/DSI SYSTEM c32**
M. L. Kerridge *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 79-82 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

An analog line signalling system for use via the European Communications Satellite was tested on OTS. Clipping of

interregister signalling and the effect of freeze out, i.e., when demand for channels exceeds supply, were subjected to normal (gain = 2, activity/circuit 30%) and overload (gain = 2.4, activity 0%) conditions. Installed capacity was 120 terrestrial channels (TC) and 60 satellite channels. The use of a speech activity simulator allowed up to 240 TC's to be simulated. Performance is good, with no clipping under normal conditions. During overload, call failures due to loss of the pulsed register signal are low. Clipping is reduced by using satellite overload channels, and is affected by the level of signalling activity on circuits routed via the DSI terminal. Author (ESA)

**N82-14189#** Telespazio, S.p.A., Rome (Italy).
**ANALOGUE TELEVISION TESTS** **c32**
V. Speziale, Y. Tharaud (Centre National d'Etudes des Telecommunications), and D. C. Savage (British Broadcasting Corp.) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 83-88 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Tests involving a single television program/transponder and two television program/transponder were carried out on OTS in order to check the performance of the European Communication Satellite (ECS) against the criteria of users. Exact simulation of ECS was not possible, but results for single program, color video signals, a high quality sound signal, teletext and 625 line test signals indicate that performance should be adequate. Adjacent channel interference tests show that, under normal conditions, user requirements should be met 99% of the time. Cochannel interference should be minimal if the transponders with orthogonal polarization are offset by 35 MHz. Two programs/transponder performance is inadequate. Author (ESA)

**N82-14190#** Independent Broadcasting Authority, Winchester (England).
**EXPERIMENTAL DIGITAL TELEVISION TRANSMISSIONS THROUGH THE OTS** **c32**
D. K. W. Hopkins (British Broadcasting Corp.), D. W. Osborne, N. D. Wells, and E. J. Wilson (British Broadcasting Corp.) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 89-92 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Digital television using satellites was studied. A 60 Mbit/sec signal, including 2.048 Mbit/sec for sound and other data, was used. The bit error rate (BER) of the satellite link was measured for a range of Eb/No values (Eb = Energy/bit, No = noise power unit bandwith) at ground stations for various operating conditions, e.g., saturated or with interference. Results show that cycle skips occur, but can be eliminated by filters. Digital systems show significantly reduced interference potential to other systems sharing the same frequency band, compared to analog television. In a power limited satellite system, impairment due to BER limits performance, but subjective impairments are very small. Author (ESA)

**N82-14191#** Independent Broadcasting Authority, Winchester (England).
**DIRECT BROADCASTING EXPERIMENTS WITH OTS: RESULTS OF PICTURE TRANSMISSION TESTS** **c32**
D. C. Griffiths (Radiotelevisione Italiana) and R. Orta *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 93-99 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

The viability of satellite picture broadcasting, using frequency modulation in the 27 MHz band was investigated. Subjective and objective quality assessments are reported. Test transmissions of 625 lines, with 13.5 MHz/V peak to peak carrier deviation and 600 KHz peak to peak energy dispersal were examined for signal to noise ratio, picture distortion, frequency deviation, the effect of threshold extension demodulators, and crosspolar cancellation. Picture quality is good where the carrier to noise ratio exceeds 14 db, but intermodulation causes degradation if closely spaced subcarriers are used above the vision signal. The propagation effect of attenuation degrades the video signal to noise ratio a small percentage of the time. Author (ESA)

**N82-14192#** Institut fuer Rundfunktechnik, Munich (West Germany).
**DIRECT BROADCASTING EXPERIMENTS WITH OTS: RESULTS OF SOUND TRANSMISSION TESTS** **c32**
C. Dosch and J. Georgy (Telediffusion de France) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 100-104 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Tests carried out with the broadcasting of a multiplex of independent analog subcarriers (instead of television signals) and with a digital modulated subcarrier in order to provide high quality sound channels, are reported. Objective and subjective simulations of operating conditions indicate that sound associated with pictures can be transmitted with quality equal to that of terrestrial links. Analog frequency modulated sound carriers are best when transmitting only one sound channel, digital for more than two, and either for exactly two. Author (ESA)

**N82-14193#** Radiotelevisione Italiana, Milan (Italy).
**TELETEXT AND DATA BROADCASTING EXPERIMENTS WITH OTS** **c32**
R. Orta and D. Pommier (Centre Commun d'Etudes de Television et de Telecommunications) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 104-107 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Decoding margin and bit error rate (BER) were used to assess the suitability of satellites for teletext and data broadcasting. Ground stations examined parameters, including influence of the sound subcarrier, statistical independence of errors and the use of threshold extension demodulators. If 0.001 is the maximum acceptable BER, a well aligned demodulator maintains service with a minimum carrier/noise ratio between 8.5 and 9 db, i.e., an operating margin (decoding margin) from 0 to 10% (0.5 to 1 db expressed in equivalent degradation of carrier/noise ratio). For domestic users, a larger operating margin, 30% or 2 db, is desired. Other parameters studied, receiver mistuning, frequency deviation, etc., do not significantly influence service quality. Author (ESA)

**N82-14194#** Telespazio, S.p.A., Rome (Italy).
**THE MEASUREMENT OF EARTH STATION PERFORMANCES AND ITS IMPACT ON FUTURE DESIGN** **c14**
S. Tirro, M. Fornari, and M. Giovanni *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 108-113 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Methods used to measure antenna gain are discussed. Values obtained for the path loss method, using a boresight at 11 and 14 GHz, for a radio star at 11.45 GHz, and for the photogrammetric method are compared. Antenna polarization purity measurement and problems encountered on matching and equalization are treated. Radio stars are the most convenient method and are less expensive than boresights. Photogrammetry can indicate corrective actions needed to achieve required performance. Polarization purity can only be proved by a very good boresight. This can be a major problem for systems with frequency reuse by polarization discrimination. The use of a satellite to replace the boresight needs further investigation. Matching and equalization problems must be overcome for commercial stations. Author (ESA)

**N82-14195#** Centre National d'Etudes des Telecommunications, Saclay (France).
**EARTH STATION MEASUREMENT TECHNIQUES AND LESSONS IN EARTH STATION DESIGN** **c14**
J. LeLigne *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 114-117 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Classical RF tests, analog television tests, digital transmission tests, and time division multiple access (TDMA) tests are discussed in relation to the OTS test program. Radio frequency equipment in the 11 and 14 GHz bands are evaluated. Receiver equipment operated nonstop for three years. Transmission equipment was switched off, or on standby, when not operating. Experiments of 8 to 12 hrs tested reliability, and of 4 to 8 days tested stability of equipment characteristics. Receiver equipment shows no failures. The stability of low noise receivers is + or - 0.2 db/day. The stability of transmission power is + or -

0.3 db/day. A 2 kw traveling wave tube was replaced after 9000 hrs. Author (ESA)

**N82-14196#** European Space Agency, Paris (France).
**AN OVERVIEW OF THE DESIGN AND CONSTRUCTION OF SMALL EARTH STATIONS USED WITH OTS** **c14**
C. D. Hughes, G. Bommas, W. Dobson, L. Sundin (Ericson (L. M.), G. Pellegrineschi (Satellite Telecommunicatons Sta.), J. Salomon, and G. Wood *In its* OTS: 3rd Year in Orbit Aug. 1981 p 118-127 Prepared in cooperation with Dornier-Werke GmbH, Marconi Communications System, Ltd. and Telespace and Ferranti Ltd. (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Ground stations with an antenna diameter < 5 m used for propagation, data transmission, and communication and television demonstrations during the OTS test program are listed. Location, equipment, and typical examples of each type are described. Most stations use 3 m antennas, but further rationalization and standardization is urged in order to avoid duplication of effort, to increase cost effectiveness and to make the system more competitive economically. Author (ESA)

**N82-14197#** European Space Agency, Noordwikj (Netherlands).
**STELLA AND SPINE DATA TRANSMISSION EXPERIMENTS: PRELIMINARY RESULTS AND CONCLUSIONS** **c32**
P. Bartholome, M. G. N. Hine (European Organization for Nuclear Research), and J. O. Scalan (Univ. College, Dublin) *In its* OTS: 3rd Year in Orbit Aug. 1981 p 128-131 ref (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

High speed data tansmission by satellite, investigated during the STELLA and SPINE OTS experiments, is treated. Differences between the systems concern data processing rather than modems, antennas, etc. In STELLA, retransmission requires backspacing while SPINE uses disk buffers. In SPINE the link driving minicomputer cannot handle transmit and receive simultaneously, so burst cycle time depends on satellite link delay, whereas STELLA is duplexed, with an external timer. Problems with STELLA arise from bit patterns containing long strings of zeros. These interfere with synchronization of a burst modem for regular and frequent zero-one transitions. Also, high error rates when signal and noise levels are normal remain unexplained. For SPINE, buffer sizing is a problem, but otherwise it performs well. Author (ESA)

**N82-14198#** British Telecom International (England).
**THE USE OF OTS IN THE COST 211 PROJECT** **c84**
J. R. Taylor *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 132-133 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

Progress in the COST 211 project, redundancy reduction techniques for visual telephone signals (related to videoconferencing), is reported. Codecs built in four different countries show good compatability. Satellite transmission links via OTS are good, and under normal conditions the effect of transmission errors on picture quality is almost nonexistent. Problem solving is helped by a real time interactive video link. Author (ESA)

**N82-14199#** Ruhr Univ., Bochum (West Germany). Bereich Extraterrestrische Physik.
**PREPARATORY TASKS ON THE DEFINITION AND OPTIMIZATION OF THE OUT OF ECLIPTIC ZODIACAL LIGHT EXPERIMENT Final Report, Feb. 1980**
Richard H. Giese, Gerhard H. Schwehm, and Dieter Hablick Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 43 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-009; ISSN-0170-1339) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9,50

The experiment consists of a scanning photopolarimeter, developed on the basis of the Helios Zodiacal Light Experiment. The scientific objectives are to study the spatial distribution of the interplanetary dust cloud, to investigate the diffuse brightness of the background star light when the sonde is above the zodiacal light cloud, and to search for a possible contribution of interstellar dust particles to the zodiacal light cloud. The instrument allows simultaneous measurements in two separate wavelength bands (UV and visual channel). Measurements are performed near 200, 220, 240, 280, 350 (UV) and at 360, 440, 540, 640, and 800 nm, including the state of polarization (Stokes parameters I, Q, U). First estimates of expected brightness values at selected viewing directions are presented for typical phases of the mission. Author (ESA)

**N82-14200#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Abteilung ERTK.
**CRITICAL ANALYSIS OF GRADIENT AND ISOTHERMAL FURNACE CONCEPTS FOR USE IN SPACELAB WITH SPECIAL REGARD FOR HEAT PIPE TECHNOLOGY AND CONNECTED BASIC REQUIREMENTS Final Report**
Harald Lenski Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 189 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-019; ISSN-0170-1339) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 35,80

The detailed design of the oven is presented. The maximum heater temperature is 2000 K for a heating power of 400 W. Gradients up to 150 K per cm are expected in a cylindrical copper sample of 10 mm diameter. Quenching of the samples during solidification by means of water evaporitive cooling is included. The utilization of a heat pipe furnace was discarded, since the Spacelab safety measures imposed by the usage of alkali metals in high temperature heat pipes were shown to offset its potential advantages with respect to conventional oven designs. Author (ESA)

## 13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

**N82-14124#** Royal Aircraft Establishment, Farnborough (England).
**RESEARCH RESULTS FROM ANALYSIS OF SATELLITE ORBITS**
D. G. King-Hele *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 3-11 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14126#** Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
**ACCURATE ORBIT DETERMINATIONS FROM LASER RANGE OBSERVATIONS BY LAGEOS, STARLETTE AND GEOS 3**
K. F. Wakker and B. A. C. Ambrosius *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 25-35 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14128#** Pisa Univ. (Italy). Gruppo di Meccanica Spaziale.
**MODELING OF ORBITAL PERTURBATIONS DUE TO RADIATION PRESSURE FOR HIGH EARTH SATELLITES**
L. Anselmo, P. Farinella, A. Milani, and A. M. Nobili *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 47-52 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14140#** European Space Operations Center, Darmstadt (West Germany).
**THE USEFULNESS OF AUXILIARY TRANSFER ORBIT MANEUVERS FOR A NEAR NOMINAL GEOSTATIONARY MISSION**
F. Hechler, M. Rosengren, and M. Soop *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 183-187 (For primary document see N82-14123 05-12)

Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14142#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Wesseling (West Germany).
**STATION ACQUISITION AND STATIONKEEPING WITH LOW THRUST SYSTEMS**
M. Eckstein and F. Hechler (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 197-208 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14143#** Columbia Univ., New York.
**AN INVESTIGATION OF THE ANOMALOUS ATTITUDE MOTION OF THE ISEE B SPACECRAFT**
Richard W. Longman and J. Andre Massart (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 211-224 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14152*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PRESENT STATUS AND FUTURE TRENDS IN NEAR-EARTH SATELLITE ORBIT DETERMINATION**
A. J. Fuchs *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 287-292 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22A

**N82-14154#** Analytical and Computational Mathematics, Zurich (Switzerland).
**AN ANALYTICAL SINGULARITY-FREE ORBIT PREDICTOR FOR NEAR-EARTH SATELLITES**
G. Scheifele *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 299-305 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14155#** Chinese Academy of Sciences, Peking. Space Science and Technology Center.
**ASPECTS IN MEASURING AND CORRECTING OF SATELLITE ORBIT**
Liu Zhong-yu and Gao Huai-bao *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 307-309 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris F 160 Member States, AU, CN and NO (+20% others)

**N82-14156#** Telespazio, S.p.A., Rome (Italy).
**SIRIO 2 LASSO MISSION: GEOSYNCHRONOUS SATELLITE LASER STATION RANGING DATA ORBIT DETERMINATION SIMULATIONS**
G. Vulpetti *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 313-323 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14157#** Indian Space Research Organization, Bangalore.
**ORBIT AND ATTITUDE DETERMINATION FOR BHASKARA**
R. S. Bhat, P. Rajendra Prased, N. Ramani, P. Padmanabhan, and K. Harendranath *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 325-332 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14161#** National Aerospace Lab., Amsterdam (Netherlands).
**THE USE OF ESA STARMAPPER MEASUREMENTS FOR SPACECRAFT ESTIMATION: ESTIMATOR DESIGN RATIONALE AND RESULTS**
P. T. L. M. vanWoerkom, F. J. Sonnenschein, and G. Moek *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 361-372 refs (For primary document see N82-14123 05-12)
(Contracts ESTEC-2383/75/AK; ESTEC-3625/78/AK; ESOC-4133/79/D-IM)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14162#** Indian Space Research Organization, Bangalore.
**VALIDATION AND OPERATIONS EXPERIENCE RELATED TO ORBIT AND ATTITUDE SOFTWARE OF BHASKARA**
K. S. Prabhu, S. K. Sinha, N. Ramani, C. Sreehari Rao (SHAR Centre, Sriharikota, India), and P. Soma (SHAR Centre, Sriharikota, India) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 375-383 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

**N82-14201#** Army Missile Command, Redstone Arsenal, Ala.
**TERRAIN MASKING ANALYSIS FOR WHITE SANDS MISSILE RANGE EAST CENTER 50 AND WEST CENTER 50**
Samuel O. Dunlap Jul. 1981 54 p refs
(AD-A105806; AD-E950156; DRSMI/RE-81-25-TR) Avail: NTIS HC A04/MF A01 CSCL 17/9

An analysis was made of terrain making for selected ground radar test locations at White Sands Missile Range. Digitized terrain altitude data are reformatted to allow calculation of straight line masking along radial profiles from the radar site. These data are then displayed in the form of maps of the illuminated terrain and altitude profiles. GRA

**N82-14148*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**FUTURE IN GROUND BASE ATTITUDE SUPPORT ACTIVITIES**
R. D. Werking and L. J. Happel (Old Dominion Systems Inc.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 255-262 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22D

**N82-14150#** National Aerospace Lab., Emmeloord (Netherlands).
**THE OBSERVATION PLANNING FACILITY FOR THE INFRARED ASTRONOMICAL SATELLITE (IFAS)**
E. Oord, P. J. dePagter, R. C. vanHoltz, and J. R. Mcdougall (Rutherford and Appleton Labs., Chilton, England) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 269-280 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14167#** Centre National d'Etudes Spatiales, Toulouse (France).
**SKYLAB DECAY FOLLOW-UP**
J. P. Carrou *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 421-430 ref (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14194#** Telespazio, S.p.A., Rome (Italy).
**THE MEASUREMENT OF EARTH STATION PERFORMANCES AND ITS IMPACT ON FUTURE DESIGN**
S. Tirro, M. Fornari, and M. Giovanni *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 108-113 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14195#** Centre National d'Etudes des Telecommunications, Saclay (France).
**EARTH STATION MEASUREMENT TECHNIQUES AND**

**LESSONS IN EARTH STATION DESIGN**
J. LeLigne *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 114-117 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14196#** European Space Agency, Paris (France).
**AN OVERVIEW OF THE DESIGN AND CONSTRUCTION OF SMALL EARTH STATIONS USED WITH OTS**
C. D. Hughes, G. Bommas, W. Dobson, L. Sundin (Ericson (L. M.), G. Pellegrineschi (Satellite Telecommunicatons Sta.), J. Salomon, and G. Wood *In its* OTS: 3rd Year in Orbit Aug. 1981 p 118-127 Prepared in cooperation with Dornier-Werke GmbH, Marconi Communications System, Ltd. and Telespace and Ferranti Ltd. (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

# 15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

**N82-14202*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**COMPARATIVE ANALYSES OF SPACE-TO-SPACE CENTRAL POWER STATIONS**
Paul F. Holloway and L. Bernard Garrett Dec. 1981 49 p refs
(NASA-TP-1955; L-14766) Avail: NTIS HC A03/MF A01 CSCL 22B

The technological and economical impact of a large central power station in Earth orbit on the performance and cost of future spacecraft and their orbital transfer systems are examined. It is shown that beaming power to remote users cannot be cost effective if the central power station uses the same power generation system that is readily available for provision of onboard power and microwave transmission and reception of power through space for use in space is not cost competitive with onboard power or propulsion systems. Laser and receivers are required to make central power stations feasible. Remote power transmission for propulsion of orbital transfer vehicles promises major cost benefits. Direct nuclear pumped or solar pumped laser power station concepts are attractive with laser thermal and laser electric propulsion systems. These power stations are also competitive, on a mass and cost basis, with a photovoltaic power station. E.A.K.

**N82-14203*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SYSTEM ANALYSIS APPROACH TO DERIVING DESIGN CRITERIA (LOADS) FOR SPACE SHUTTLE AND ITS PAYLOADS. VOLUME 1: GENERAL STATEMENT OF APPROACH**
Robert S. Ryan, Tulon Bullock, Wayne B. Holland, Dennis A. Kross, and Larry A. Kiefling Dec. 1981 47 p
(NASA-TP-1949; M-358) Avail: NTIS HC A03/MF A01 CSCL 22B

Space shuttle, the most complex transportation system designed to date, illustrates the requirement for an analysis approach that considers all major disciplines simultaneously. Its unique cross coupling and high sensitivity to aerodynamic uncertainties and high performance requirements dictated a less conservative approach than those taken in programs. Analyses performed for the space shuttle and certain payloads, Space Telescope and Spacelab, are used a examples. These illustrate the requirements for system analysis approaches and criteria, including dynamic modeling requirements, test requirements control requirements and the resulting design verification approaches. A survey of the problem, potential approaches available as solutions, implications for future systems, and projected technology development areas are addressed. S.L.

**N82-14204*#** National Aeronautics and Space Administration, Washington, D. C.
**MISSION OPERATION REPORT: VOYAGER MISSION SUCCESS ASSESSMENT**
[1981] 6 p
(NASA-TM-84062; S-802-77-01/02) Avail: NTIS HC A02/MF A01 CSCL 22B

A favorable assessment of the Voyager Mission is based upon: (1) scientific investigations performed at seven of the major bodies of the solar system; (2) comparative studies of the Jupiter and Saturn systems, including their satellites, rings, and fields and particles environments; (3) measurements of the characteristics of the interplanetary medium from Earth to Saturn; and (4) fulfillment of the Mission Success Criteria. Fifteen mission achievements are listed. Publication of results is mentioned. The status of voyager spacecrafts 1 and 2 is reviewed. A list of ten awards is included. N.W.

**N82-14205*#** National Aeronautics and Space Administration, Washington, D. C.
**POMS, POLAR METEOROLOGICAL SATELLITE: A CONTRIBUTION FOR GLOBAL RADIATION BUDGET MEASUREMENT**
Juergen Puls Nov. 1981 29 p refs Transl. into ENGLISH from Z. fuer Flugwillenschaften und Weltraumforschung (West Germany), v. 5, no. 2, p 94-103 Original language document was announced as A81-35787 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by DFVLR, Oberpfaffenhofen, West Germany
(Contract NASw-3542)
(NASA-TM-76642) Avail: NTIS HC A03/MF A01 CSCL 22B

A proposal for a climate research mission specialized to Earth radiation budget measurements is given. This mission requires daily global coverage established by a system of three orbiting satellites. One of them is represented by the European Space Agency satellite SEOCS that is on a drifting orbit with respect to the Sun with 57 degrees inclination. The two others are polar orbiting satellites (POMS). The mission concept is treated with reference to the payload side requirements, the choice of orbit, orbital analysis, and satellite requirements. R.J.F.

**N82-14206#** Naval Postgraduate School, Monterey, Calif.
**COMPUTER PROGRAM APPLICATIONS TO TACTICAL MISSILE CONCEPTUAL DESIGN M.S. Thesis**
Martin David Sullivan Jun. 1981 200 p refs
(AD-A105788) Avail: NTIS HC A09/MF A01 CSCL 16/4

This thesis is comprised of four independent computer programs and their related operating instructions. Each of these programs focuses on a particular facet of tactical missile design. The topics covered include guidance and trajectory calculations, rocket motor propulsion sizing, warhead design, and aerodynamic coefficient determination. The programs are developed from accepted mathematical procedures and are tailored to optimize operator interaction for educational purposes. GRA

**N82-14207#** Ballistic Research Labs., Aberdeen Proving Ground, Md.
**TRAJECTORY PREDICTIONS FOR A 75 MM SOLID FUEL RAMJET TUBULAR PROJECTILE**
Carl W. Nelson Sep. 1981 25 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A105551; ARBRL-MR-03136) Avail: NTIS HC A02/MF A01 CSCL 19/4

The AFAPL ramjet design analysis code was modified to predict a point mass trajectory for a 75 mm solid fuel ramjet tubular projectile. Projectile velocity was found sensitive to the combustion efficiency relation assumed. Author (GRA)

**N82-14208#** National Oceanic and Atmospheric Administration, Washington, D. C.
**ATMOSPHERIC SOUNDING USER'S GUIDE**
Adolf Werbowetzki Apr. 1981 92 p refs
(PB81-230476; NOAA-TR-NESS-83; NOAA-81062602) Avail: NTIS HC A05/MF A01 CSCL 22B

The TIROS operational vertical sounder (TOVS) on TIROS-N series satellites replaced the vertical temperature profile radiometer (VIPR) flown on earlier polar orbiting spacecraft. Since the successful launch of TIROS-N and the change-over to TOVS, many papers and articles were presented concerning the various

aspects of the TOVS hardware/software system. The significant features of the TOVS operational system are presented. T.M.

**N82-14131#** Centre National d'Etudes Spatiales, Toulouse (France).
**OPERATIONAL LOADS INDUCED BY ORBITAL CONTROL OF A GEOSTATIONARY SATELLITE [LES CHARGES OPERATIONNELLES INDUITES PAR LE CONTROLE EN ORBITE D'UN SATELLITE GEOSTATIONNAIRE]**
G. Cales *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 73-80 refs In FRENCH (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14132#** Amsat-Deutschland e.V., Marburg (West Germany).
**THE ATTITUDE CONTROL SYSTEM OF AMSAT P 3 SATELLITES**
Karl Meinzer *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 81-84 ref (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14133#** European Space Operations Center, Darmstadt (West Germany).
**IRREGULARITIES IN THE MOTION OF SPIN STABILIZED EARTH SATELLITES**
L. Fraiture, N. Wiengarn, and B. Chambaz (Applications Mathematiques et Logiciel, SARL) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 87-104 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14134*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**HIGH PRECISION ATTITUDE DETERMINATION FOR MAGSAT**
G. Abshire, R. McCutcheon, G. Summers, F. VanLandingham, and G. Meyers *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 105-116 refs Prepared in cooperation with Computer Science Corp., Silver Spring, Md. (For primary document see N82-14123 05-12)
(Contract NAS-5-24300)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22A

**N82-14137#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**GEOSTATIONARY SATELLTES LAUNCHED BY NASDA. PART 1: NASDA TRACKING AND CONTROL SYSTEM**
T. Takenouchi and M. Suzuki *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 151-155 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14138#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**GEOSTATIONARY SATELLITES LAUNCHED BY NASDA. PART 2: MISSION ANALYSIS FOR MANEUVER**
A. Tanaka, M. Utashima, K. Inamiya (Mitsubishi Electric Corp.), T. Ogino (Mitsubishi Electric Corp.), and T. Shimizu (Fujitsu Ltd.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 157-166 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14144#** European Space Agency, Toulouse (France). Earth Observation Programme Office.
**A EUROPEAN FLIGHT DYNAMICS EXPERIMENT**
P. Boland *In its* Spacecraft Flight Dyn. Aug. 1981 p 225-232 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14148#** European Space Research and Technology Center, Noordwijk (Netherlands).
**ON SPIN MANEUVERS WITH A SYMMETRIC SATELLITE**
F. Janssens *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 263-268 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14166#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**INCLINATION CONTROL USING A PULSE MODE AXIAL THRUSTER**
M. Suzuki and K. Yoneyama *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 417-420 (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14174#** European Space Agency, Paris (France).
**PERFORMANCE OF THE ORBITAL TEST SATELLITE (OTS) DURING ITS THIRD YEAR OF OPERATION IN ORBIT**
*In its* OTS: 3rd Year in Orbit Aug. 1981 71 p (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14176#** British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
**GENERAL DESCRIPTION OF THE ORBITAL TEST SATELLITE (OTS)**
D. E. McLaurin and D. N. Gregory *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 12-17 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14181#** European Space Agency, Noordwikj (Netherlands).
**PLATFORM PERFORMANCE FACTORS AFFECTING LINK BUDGETS OF GEOSYNCHRONOUS COMMUNICATION SATELLITES**
L. vanHoltz and S. Fagg *In its* OTS: 3rd Year in Orbit Aug. 1981 p 41-47 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

# 16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

**N82-14209*#** Martin Marietta Aerospace, Denver, Colo.
**SPACE TUG SYSTEMS STUDY (STORABLE). VOLUME 1: OVERVIEW PRESENTATION Final Report**
Jan. 1974 111 p 3 Vol.
(Contract NAS8-29675)
(NASA-CR-161919; MCR-73-314-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 22B

Program plans are established for a storable propellant space tug used to perform high energy orbit transfers from the space transportation system (STS) orbiter. The mission model for the STS in the 1980's is analyzed. Performance and mission requirements are determined. Various flight operations modes are evaluated and selected. Subsystems are selected and synthesized into various tug configurations. Program options for these configurations are defined, analyzed, and selected. Selected program options are further defined and optimized, including program requirements, tug vehicle definition, mission accomplishment, ground and flight operations, programmatics and costs.
Author

**N82-14210*#** Martin Marietta Aerospace, Denver, Colo.
**SPACE TUG SYSTEMS STUDY. VOLUME 2: COMPENDIUM Final Report**
Jan. 1974 318 p refs 3 Vol.
(Contract NAS8-29675)
(NASA-CR-161920; MCR-73-314-Vol-2) Avail: NTIS HC A14/MF A01 CSCL 22B

Possible storable propellant configurations and program plans are evaluated for the space tug. Alternatives examined include:

use of existing expendable stages modified for use with shuttle, followed by a space tug at a later date; use of a modified growth version of existing expendable stages for greater performance and potential reuse, followed by a space tug at a later date; use of a low development cost, reusable, interim space tug available at shuttle initial operational capability (IOC) that could be evolved to greater system capabilities at a later date; and use a direct developed tug with maximum potential to be available at some specified time after space shuttle IOC. The capability options were narrowed down to three final options for detailed program definition. S.L.

**N82-14211*#** Martin Marietta Aerospace, Denver, Colo.
**SPACE TUG SYSTEMS STUDY (STORABLE). VOLUME 3: EXECUTIVE SUMMARY Final Report**
Jan. 1974 37 p refs 3 Vol.
(Contract NAS8-29675)
(NASA-CR-161918; MCR-73-314-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 22B

Space tug program options that consider key issues and mission requirements are assessed, component and subsystem candidates are evaluated, and tug configurations synthesized. Three tug program options are defined and evaluated. S.L.

# 17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

**N82-14130#** Aerospace Corp., El Segundo, Calif.
**NAVSTAR GLOBAL POSITIONING SYSTEM (GPS): FUTURE ENHANCED CAPABILITIES**
Mohan Ananda *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 61-71 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14138*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena. Navigation Systems Section.
**DEEP SPACE NAVIGATION SYSTEMS AND OPERATIONS**
James F. Jordan *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 135-150 refs (For primary document see N82-14123 05-12)
(Contract NAS-7-100)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 22A

**N82-14139#** British Aerospace Dynamics Group, Stevenage (England). Space and Communications Div.
**L-SAT STATIONKEEPING**
J. J. Pocha and A. F. Edwards *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 169-182 (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14141#** European Space Operations Center, Darmstadt (West Germany).
**MIDCOURSE NAVIGATION FOR THE EUROPEAN COMET HALLEY MISSION**
Martin Hechler and Freidrich Hechler *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 189-195 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14160#** European Space Research and Technology Center, Noordwijk (Netherlands).
**THE DYNAMIC ATTITUDE RECONSTRUCTION METHOD**
A. G. Bird, L. Fraiture (ESOC, Darmstadt, West Germany), J. C. VanderHa (ESOC, Darmstadt, West Germany), and P. Kohler (Ecole Polytechnique Federale de Lausanne, Switzerland) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 353-360 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14163#** European Space Operations Center, Darmstadt (West Germany).
**SPACECRAFT TRACKING CAMPAIGNS AND THE ASSESSMENT OF ORBIT DETERMINATION ACCURACY**
S. Pallaschke *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 385-395 (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

**N82-14212*#** Texas Univ., Dallas. Center for Space Sciences.
**MOLECULAR WAKE SHIELD GAS ANALYZER Final Report**
John H. Hoffman 6 Aug. 1980 28 p refs Revised
(Contract NAS8-32689)
(NASA-CR-161926) Avail: NTIS HC A03/MF A01 CSCL 22B

Techniques for measuring and characterizing the ultrahigh vacuum in the wake of an orbiting spacecraft are studied. A high sensitivity mass spectrometer that contains a double mass analyzer consisting of an open source miniature magnetic sector field neutral gas analyzer and an identical ion analyzer is proposed. These are configured to detect and identify gas and ion species of hydrogen, helium, nitrogen, oxygen, nitric oxide, and carbon dioxide and any other gas or ion species in the 1 to 46 amu mass range. This range covers the normal atmospheric constituents. The sensitivity of the instrument is sufficient to measure ambient gases and ion with a particle density of the order of one per cc. A chemical pump, or getter, is mounted near the entrance aperture of the neutral gas analyzer which integrates the absorption of ambient gases for a selectable period of time for subsequent release and analysis. The sensitivity is realizable for all but rare gases using this technique. S.L.

**N82-14213*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SPACECRAFT CHARGING TECHNOLOGY, 1980**
Washington Oct. 1981 1005 p refs Conf. held in Colorado Springs, 12-14 Nov. 1980; sponsored by AFGL and NASA Lewis Research Center
(NASA-CP-2182; AFGL-TR-81-0270) Avail: NTIS HC A99/MF A01 CSCL 22B

The third Spacecraft Charging Technology Conference proceedings contain 66 papers on the geosynchronous plasma environment, spacecraft modeling, charged particle environment interactions with spacecraft, spacecraft materials characterization, and satellite design and testing. The proceedings is a compilation of the state of the art of spacecraft charging and environmental interaction phenomena. For individual titles, see N82-14214 through N82-14275.

**N82-14214*#** JAYCOR, Alexandria, Va.
**DIELECTRIC DISCHARGE CHARACTERISTICS IN A TWO-ELECTRON SIMULATION ENVIRONMENT**
M. Treadaway, R. Leadon, C. Mallon, T. Flanagan, R. Denson, and F. Wenaas *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 4-16 refs Sponsored by AFWL (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The results of a series of experiments in which flux levels representative of the space electron environment were used are presented and compared to the results of high flux tests. The simulation approach was to partition the space electron spectrum into two parts, those electrons which do not penetrate a material and therefore contribute to charging and those which completely penetrate the material. The nonpenetrating electrons were simulated using 25 keV electrons and the penetrating electrons by 350 keV electrons. The materials included in this investigation were Kapton, optical solar reflectors (OSRs), and a ground test satellite surface potential monitor which contained Kapton, astroquart, OSRs and teflon. S.L.

**N82-14215*#** Beers Associates, Inc., Reston, Va.
**ELECTRON-BEAM-CHARGED DIELECTRICS: INTERNAL CHARGE DISTRIBUTION**
Brian L. Beers and V. W. Pine *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 17-32 refs Sponsored by AFSD (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Theoretical calculations of an electron transport model of the charging of dielectrics due to electron bombardment are compared to measurements of internal charge distributions. The emphasis is on the distribution of Teflon. The position of the charge centroid as a function of time is not monotonic. It first moves deeper into the material and then moves back near to the surface. In most time regimes of interest, the charge distribution is not unimodal, but instead has two peaks. The location of the centroid near saturation is a function of the incident current density. While the qualitative comparison of theory and experiment are reasonable, quantitative comparison shows discrepancies of as much as a factor of two. S.L.

**N82-14216*#** Rome Air Development Center, Hanscom AFB, Mass.
**BULK CHARGING AND BREAKDOWN IN ELECTRON-IRRADIATED POLYMERS**
A. R. Frederickson *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 33-51 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

High energy electron irradiations were performed in an experimental and theoretical study of ten common polymers. Breakdowns were monitored by measuring currents between the electrodes on each side of the planar samples. Sample currents as a function of time during irradiation are compared with theory. Breakdowns are correlated with space charge electric field strength and polarity. Major findings include evidence that all polymers tested broke down, breakdowns remove negligible bulk charge and no breakdowns are seen below 20 million V/m. S.L.

**N82-14217*#** Mission Research Corp., San Diego, Calif.
**CHARGING AND DISCHARGING TEFLON**
B. C. Passenheim and V. A. J. vanLint *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 52-64 refs (For primary document see N82-14213 05-18)
(Contracts DNA001-78-C-0269; F29601-78-C-0012)
Avail: NTIS HC A99/MF A01 CSCL 22B

The charging and discharging characteristics of several common satellite materials exposed to 0-30KV electrons are measured. Teflon is discussed because the charging characteristics are radically altered immediately after a spontaneous discharge. The exterior geometry of the test structure is shown. In all cases dielectric samples were 82 cm in diameter mounted on the front of a 120 cm diameter cylinder supported on an 85 cm, 0.95 cm thick plexiglass disc. Dielectric materials investigated were: back surface aluminized Kapton, back surface silvered Teflon, silicon alkyd white thermal control paint, and 50 cm by 50 cm array of 0.030 cm thick MgF2 coated fused silica solar cell cover slips. S.L.

**N82-14218*#** Parker (Lee W.), Inc., Concord, Mass.
**EXPERIMENTAL VALIDATION OF A NUMERICAL MODEL PREDICTING THE CHARGING CHARACTERISTICS OF TEFLON AND KAPTON UNDER ELECTRON BEAM IRRADIATION**
R. C. Hazelton (Inland Research and Development Center), E. J. Yadlowsky (Inland Research and Development Center), R. J. Churchill (Inland Research and Development Center), Lee W. Parker, and B. Sellers (Panametrics, Inc.) *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 65-73 refs Sponsored by INTELSAT (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The effect differential charging of spacecraft thermal control surfaces is assessed by studying the dynamics of the charging process. A program to experimentally validate a computer model of the charging process was established. Time resolved measurements of the surface potential were obtained for samples of Kapton and Teflon irradiated with a monoenergetic electron beam. Results indicate that the computer model and experimental measurements agree well and that for Teflon, secondary emission is the governing factor. Experimental data indicate that bulk conductivities play a significant role in the charging of Kapton. S.L.

**N82-14219*#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**ROLE OF ENERGETIC PARTICLES IN CHARGING/DISCHARGING OF SPACECRAFT DIELECTRICS**
J. B. Reagan, R. W. Nightingale, E. E. Gaines, R. E. Meyerott, and W. L. Imhof *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 74-85 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The role that energetic particles in the substorm plasma have on the charging and discharging of typical dielectric layers used on spacecraft was investigated using spectra and pitch angle distributions measured in situ on the SCATHA spacecraft prior to and during a few kilovolt differential charging event in eclipse conditions. The particle spectra was input to deposition codes that determine the dose rate as a function of depth in Kapton and Teflon layers used in an experiment on SCATHA. The calculated ambient dose rates of a few rads/sec throughout the bulk of the samples are sufficiently high that radiation damage levels are reached on the time scale of 1 year. Surface dose is a factor of 100 higher. Bulk conductivity profiles were obtained from the dose rates using empirical relationships. The radiation induced bulk conductivities calculated at the peak charging time are found to be smaller than the intrinsic dark conductivity range of solar conditioned Kapton but higher than the corresponding value for Teflon. S.L.

**N82-14220*#** TRW Defense and Space Systems Group, Redondo Beach, Calif.
**ELECTRON PENETRATION OF SPACECRAFT THERMAL INSULATION**
Walter L. Powers, Barbara F. Adams, and George T. Inouye *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 86-95 refs (For primary document see N82-14213 05-18)
(Contract JPL-955500)
Avail: NTIS HC A99/MF A01 CSCL 22B

The external thermal blanket with 13 mils of polyethylene which has the known range and stopping power as a function of electron energy is investiated. The most recent omnidirectional peak Jovian electron flux at 5 Jupiter radii is applied, the electron current penetrating the thermal blanket is calculated and allowed to impinge on a typical 20 mil polyethylene insulator surrounding a wire. The radiation dose rate to the insulator is then calculated and the electrical conductivity found. The results demonstrate that the increased electronic mobility is sufficient to keep the maximum induced electric field two orders of magnitude below the critical breakdown strength. S.L.

**N82-14221*#** United Kingdom Atomic Energy Authority, Harwell (England).
**ELECTROSTATIC DISCHARGING BEHAVIOUR OF KAPTON IRRADIATED WITH ELECTRONS**
Derek Verdin *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 96-114 refs Sponsored by RAE (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The electrostatic charging and discharging of Kapton when

irradiated with monoenergetic electrons of 5 to 30 keV energy were studied. The leakage currents and rates of discharging always increased with the incident electron energy and flux, whereas the surface voltage showed a more complex behavior depending on the thickness of the material: for the thinner films it exhibited a maximum and then fell at higher energies. The surface voltage, the rate of discharging, and the peak current and total charge flow during a discharge were enhanced as the temperature was decreased from 70 C to -180 C, and were accompanied by a decreasing leakage current. Visible light or the presence of an aluminum coating on the irradiated surface caused reductions in the surface voltage and changes in the discharging characteristics. The results are discussed in terms of the leakage currents and the secondary emission of electrons. Photomicrographs taken after irradiation, and photographs of samples during irradiation, show good correlations between the positions of light flashes and of pinholes produced by the discharge arcs. S.L.

**N82-14222*#** Toronto Univ. (Ontario).
**DIELECTRIC SURFACE DISCHARGES: EFFECTS OF COMBINED LOW-ENERGY AND HIGH-ENERGY INCIDENT ELECTRONS**
K. G. Balmain and W. Hirt *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 115-128 refs Sponsored by AFWL (For primary document see N82-14213 05-18)
(Grant NsG-7647)
Avail: NTIS HC A99/MF A01 CSCL 22B

Dielectric surface discharges affected by the addition of high energy electrons at 5 pA/sq cm to a primary 20 keV, 10 nA/sq cm electron beam with the high energy broad spectrum particles coming from the beta decay of Strontium 90 are studied. Kapton exhibits significantly increased discharge strength, increased waiting time between discharges, and a decreased number of discharges per specimen before discharge cessation. Mylar exhibits similar but less pronounced effects, while Teflon is relatively unaffected. With Kapton and Mylar, the high energy electrons act in some way to delay the instant of discharge ignition so that more charge can be accumulated and hence released during discharge. S.L.

**N82-14223*#** SRI International Corp., Menlo Park, Calif.
**PRELIMINARY COMPARISON OF MATERIAL CHARGING PROPERTIES USING SINGLE-ENERGY AND MULTIENERGY ELECTRON BEAMS**
R. C. Adamo and J. E. Nanevicz *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 129-132 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Results of tests designed to compare the charging properties of spacecraft material under a monoenergetic beam and under a continuously distributed beam are summarized. In the test setup the electron source was mounted in the top of a cylindrical vacuum chamber. A sheet of 5-mil-thick Kapton was placed on an insulated metal substrate at the bottom of the vacuum chamber. The dc current arriving on the substrate was measured and a field meter measured the potential of the test sample. A retarding potential analyzer measured the energy spectrum of the incident electron beam. With the monoenergetic beam, the sample charged to 12 kV and electrical discharges occurred. With the multi-energy spectra the samples charged to only 6 kV and 4 kV, and no discharger were observed. In these experiments, no effort was made to duplicate the spectra occurring in space. The tests were intended to simply to compare spacecraft material charging properties using monoenergetic and continuous multi-energy beams. M.D.K.

**N82-14224*#** TRW Defense and Space Systems Group, Redondo Beach, Calif.
**BRUSHFIRE ARC DISCHARGE MODEL**
G. T. Lnouye *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 133-162 refs (For primary document see N82-14213 05-18)
(Contract NAS3-21961)
Avail: NTIS HC A99/MF A01 CSCL 22B

A one dimensional arc discharge model incorporating a brushfire-type propagation of a discharge wavefront was investigated. A set of equations, developed and their which include electrical, thermal and plasma parameters, were solutions shown to be consistent with a propagating brushfire wavefront. Voltage, current, plasma density, temperature, and resistivity profiles were obtained. Mechanical forces, magnetic and electrostatic were considered in evaluating the flashover to blowout current ratio, G', for arc discharges with the brushfire parameters developed in the model. This ratio is an important factor in determining the electromagnetic interference (EMI) impact of arc discharges on spacecraft electrical subsystems. The conclusion of the analysis is that electrostatic forces are much more important than magnetic forces. The magnitude of the G' factor obtained, 58.5 percent, is within the range of those obtained by experimental means. Improvements in the analytical model as well in the experimental approach are recommended. M.D.K.

**N82-14225*#** Aerospace Corp., El Segundo, Calif.
**EFFECTS OF SECONDARY ELECTRON EMISSION ON CHARGING**
Martin S. Leung, Michael B. Tueling, and Edwin R. Schnauss *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 163-178 refs (For primary document see N82-14213 05-18)
(Contract F04701-80-C-0081)
Avail: NTIS HC A99/MF A01 CSCL 22B

Laboratory charging studies using two electron sources with different energies show that the charging behaviors of typical spacecraft thermal control dielectric surface are extremely sensitive to the shape of their secondary emission curves. The results also suggest that the electron spectrum in a natural charging environment can be separated into three distinct regions (noninteracting, discharging, and charging) depending on the kinetic energy of the incident electron relative to the charged surface, and on the secondary emission characteristics of the material. To a first order approximation, the relative number of electrons in these different regions determines the potential of the charged surface. Detailed measurements of the secondary electron emission characteristics of Kapton, the effects of bulk conductivity and secondary emission on surface charging of these materials is reported. M.D.K.

**N82-14226*#** Case Western Reserve Univ., Cleveland, Ohio.
**SECONDARY ELECTRON EMISSION YIELDS**
I. Krainsky, W. Lundin, W. L. Gordon, and R. W. Hoffman *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 179-197 refs (For primary document see N82-14213 05-18)
(Grant NsG-3197)
Avail: NTIS HC A99/MF A01 CSCL 22B

The secondary electron emission (SEE) characteristics for a variety of spacecraft materials were determined under UHV conditions using a commercial double pass CMA which permits sequential Auger electron electron spectroscopic analysis of the surface. The transparent conductive coating indium tin oxide (ITO) was examined on Kapton and borosilicate glass and indium oxide on FED Teflon. The total SEE coefficient ranges from 2.5 to 2.6 on as-received surfaces and from 1.5 to 1.6 on Ar(+) sputtered surfaces with $<$ 5 nm removed. A cylindrical sample carousel provides normal incidence of the primary beam as well as a multiple Faraday cup measurement of the approximately nA beam currents. Total and true secondary yields are obtained from target current measurements with biasing of the carousel. A primary beam pulsed mode to reduce electron beam dosage and minimize charging of insulating coatings was applied to Mg/F2 coated solar cell covers. Electron beam effects on ITO were found quite important at the current densities necessary to do Auger studies. M.D.K.

**N82-14227*#** Pennsylvania State Univ., University Park.
**OBLIQUE-INCIDENCE SECONDARY EMISSION FROM CHARGED DIELECTRONICS**
James W. Robinson and Paul A. Budd *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 198-210 refs (For primary document see N82-14213 05-18)
(Grant NsG-3166)
Avail: NTIS HC A99/MF A01 CSCL 22B

Experimental measurements and computer simulation of secondary electron emission coefficients for FEP-Teflon, for normal and oblique incidence in the presence of a normal electric field

are reported. Knowledge of the electrostatic environment surrounding the specimen calculation of particle trajectories are considered. A simulation using a conformal mapping, a Green's integral, and a trajectory generator provides the necessary mathematical support for the measurements which have been made with normal fields of 1.5 and 2.7 kV/mm. When incidence is normal and energy exceeds the critical energy, the coefficient is given by V.58 and for oblique incidence this expression may be divided by the cosine of the angle. The parameter V sub 0 is a function of normal field. Measurements for values of V sub f are presented. M.D.K.

**N82-14228*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**TANK TESTING OF A 2500-cm2 SOLAR PANEL**

Renate S. Bever and John Staskus (NASA. Lewis Research Center) *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 211-227 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

A 50 cm by 50 cm solar array panel test patch was investigated for spacecraft charging and arcing effects. Bombardment with monochromatic electron was carried out. Some objectives of the test were: (1) to estimate at what voltage of electron bombardment arcing would be probable; (2) to find whether the arc's energy would be tolerable or damagingly large; (3) to try and separate thermal and photoeffects; and, (4) to see whether materials used were such as to minimize arcing. Some conclusions were: In sunlight the tracking data relay satellite's solar panel which has ceria glass on the front and conductive paint on the backside is probably a good design for reducing charge-up. In a geomagnetic substorm simulated in testing there will be arcing at the interconnects during eclipse and transitions into and out of eclipse in testing especially in view of the very cold temperatures that will be reached by this lightweight array. Ceria-doped glass is preferred to fused silica glass for reducing charge build up. The Kapton bare patch should still be conductively painted. The differential voltages on the panel determine when arcing first begins, and the electron beam voltages vary depending upon whether the metallic structure is directly grounded or semifloating. M.D.K.

**N82-14229*#** Lockheed Missiles and Space Co., Sunnyvale, Calif.

**CHARGING AND DISCHARGING CHARACTERISTICS OF A RIGID SOLAR ARRAY**

George F. Brady, Jr., David A. Vance, and Stanely A. Greenberg *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 228-236 (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

Two rigid solar array panels were subjected to a simulated geosynchronous orbit substorm environment. During the charging sequence, distributions of accumulated surface charge were measured under eclipse and sunlight conditions. Discharge evénts were characterized with respect to voltage pulse signatures and amplitudes on the solar array bus leads. Post-exposure analysis of the solar array panels indicated that the electrical characteristics were not degraded in spite of the substantial discharge actvity. However, significant cratering and discoloration of the Tedlar dielectric were observed. Author

**N82-14230*#** European Space Research and Technology Center, Noordwijk (Netherlands).

**MATERIALS CHARACTERIZATION STUDY OF CONDUCTIVE FLEXIBLE SECOND SURFACE MIRRORS**

F. Levadou, S. J. Bosma, and A. Paillous (DERTS) *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 237-260 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

The status of prequalification and qualification work on conductive flexible second surface mirrors is described. The basic material is FEP Teflon witn either aluminium or silver vacuum deposited reflectors. The top layer has been made conductive by deposition of layer of a indium oxide. The results of a prequalification program comprised of decontamination, humidity, thermal cycling, thermal shock and vibration tests are presented. Thermo-optical and electrical properties. The results of a prequalification program comprised of decontamination, humidity, thermal cycling, thermal shock and vibration tests are presented. Thermo-optical and electrical properties, the electrostatic behavior of the materials under simulated substorm environment and electrical conductivity at low temperatures are characterized. The effects of simulated ultra violet and particles irradiation on electrical and thermo-optical properties of the materials are also presented. M.D.K.

**N82-14231*#** British Aerospace Public Ltd. Co., Bristol (England). Space and Communications Div.

**DESIGN OF AN ARC-FREE THERMAL BLANKET**

Christakis N. Fellas *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 261-266 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

The success of a multilayer thermal blanket in eliminating arcing is discussed. Arcing is eliminated by limiting the surface potential to well below the threshold level for discharge. This is achieved by enhancing the leakage current which results in conduction of the excess charge to the spacecraft structure. The thermal blanket consists of several layers of thermal control (space approved) materials, bonded together, with Kapton on the outside, arranged in such a way that when the outer surface is charged by electron irradiation, a strong electric field is set up on the Kapton layer resulting in a greatly improved conductivity. The basic properties of matter utilized in designing this blanket method of charge removal, and optimum thermo-optical properties are summarized. M.D.K.

**N82-14232*#** General Electric Co., Fairfield, Conn.

**CHARGING CONTROL TECHNIQUES**

R. E. Schmidt *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 267-286 refs (For primary document see N82-14213 05-18)

(Contract F33615-78-C-5119)

Avail: NTIS HC A99/MF A01 CSCL 22B

Transparent conductive thin films of indium oxide and indium-tin oxide were evaluated for their properties to control charge buildup on satellite materials. Both oxide coatings were evaluated for their uniformity, stability, reproducibility and characteristics on various substrate materials such as FEP Teflon, Kapton, and glass. The process development toward optimization and characterization of these thin semiconductor oxide coatings and the evaluation on large sizes performed for qualification for use on thermal control satellite materials is described. The materials have been characterized in multiple energy electron plasma environment and at low temperatures. All radiation measurements of the coatings under simulated substorm conditions have exhibited the characteristics of stable charge control. Measurement of surface potential during and after irradiation by electrons up to 30 KeV and ionizing gamma radiation show an effective stable grounding surface. M.D.K.

**N82-14233*#** Centre d'Etudes et de Recherches, Toulouse (France).

**CHARGING CHARACTERISTICS OF SILICA FABRICS**

Leon Levy and Alain Pallous *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1981 p 287-308 refs (For primary document see N82-14213 05-18)

(Grants AF-AFOSR-3704-78; AF-AFOSR-0183-80)

Avail: NTIS HC A99/MF A01 CSCL 22B

The charge dissipation mechanism of silica fabrics and silica fabric/Aluminum composites was studied by means of various sample configurations tested under monoenergetic electron beams at energies between 5 and 20 keV. Grounding of the aluminum rear face of the composite is necessary in order to ensure a good electrostatic performance. The surface potentials are dependent on the flux rate in the range 10 pA -cm(2-) to 3 nA cm(-2); they are the highest at the lowest flux rate. Strong discharges have been evidenced at 20 keV but do not occur under 15 keV electrons. A substantial decrease in the surface potential of the sample is observed every time that an irradiation by low energy electrons ( 2 to 4 keV) is performed simultaneously with the irradiation by medium-energy electrons (10 to 20 keV). Silica fabrics and composites are very sensitive of contamination or contamination-plus-irradiation effects. M.D.K.

**N82-14234*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**ELECTROSTATIC CHARGING CHARACTERISTICS OF THERMAL CONTROL PAINTS AS FUNCTION OF TEMPERATURE**
Paul A. Robinson, Jr. (Hughes Research Labs.) and A. C. Whittlesey *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 209-319 refs (For primary document see N82-14213 05-18)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 22B

The charging characteristics of paints for various uses on spacecraft under electron bombardment were studied. It was found that there is not a strong temperature dependence of the charging characteristics between -155 C and +30 C; and there is a noticeable hystereis effect as the electron beam energy is varied. Furthermore, all of the paints tested exhibit large secondary yields at low (approx. 1 keV) bombarding electron energies; and surfaces can charge either positively or negatively depending on the conditions and the paint. It was concluded that paints are not simple, will require more detailed study, and will probably act differently in multiple energy electron tests. N.W.

**N82-14235*#** Hughes Research Labs., Malibu, Calif.
**EVALUATION OF CHARGE CONTROL TECHNIQUES ON SPACECRAFT THERMAL SURFACES (ELECTROSTATIC DISCHARGE STUDY)**
Paul A. Robinson, Jr., E. M. Brown, S. M. Conan, C. R. Dulgeroff, W. R. Elkman, G. J. Holm, L. C. Lawton, G. J. Pack, and D. L. Shannon *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 320-341 (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The charging and discharging characteristics of various dielectric materials commonly used on spacecraft were tested. The experimental apparatus and the calculations used to analyze the data generated during the testing are described. The test technique, results, and analysis used are presented. Indium tin oxide coated Teflon, Kapton, and quartz do not charge significantly. CTL 15 white paint shows no large charge build up. Pinholes in Teflon and Kapton increase the leakage through the sample and reduce the energy released in an arc. Conductive grids in Teflon and Kapton reduce the arc energy by two orders of magnitude over untreated samples. Extreme low temperatures (-195 C) do not significantly increase the arc energy of the gridded sample. N.W.

**N82-14236*#** Communications Satellite Corp., Washington, D.C.
**CONDUCTION THROUGH PUNCTURES IN METAL-BACKED DIELECTRICS**
A. Meulenberg and Paul A. Robinson, Jr. (JPL, California Inst. of Technology, Pasadena) *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 342-352 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A theoretical mechanism to explain the main features of experiments with punctured spacecraft-thermal-blanket materials is presented. The model is based on consideration of the electric fields developed about punctures; the focusing of primary electrons toward the punctures; the generation, migration, and cascade of secondary electrons along the surface; and the radiation induced conductivity characteristics of thin dielectric films. Qualitative predictions of the model agree with experiment results N.W.

**N82-14237*#** Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
**ACCELERATED ALPHA-S DETERIORATION IN A GEOSTATIONARY ORBIT**
Otto K. Husmann *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 353-364 refs Sponsored by Bundesministerium fuer Forschung und Technologie (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Between the Teflon substrate and the interference filter a 2 micron varnish layer was sandwiched in. The bending radius of the SSM, measured on a cone, decreased from about 13 mm to 6 mm prior to interference filter fracture, due to increased tensile strength of its substrate. These samples, and for comparison samples of the same make but without varnish and a conductive layer were included in the test. Additionally 2 Teflon FEP samples without the protective interference filter, one of them with a conductive layer, were tested. The sample substrate was 125 micron Teflon FEP, with vapor deposited silver reflector and a thin Inconel film for corrosion protection. N.W.

**N82-14238*#** Air Force Space Div., Los Angeles, Calif.
**OPERATIONAL STATUS OF THE SPACE TEST PROGRAM P78-2 SPACECRAFT AND PAYLOADS**
Richard N. Osgood *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 365-369 (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Operations of the P78-2 spacecraft and its 12 payloads, which attempt to measure the buildup and breakdown of charge on various spacecraft components and to characterize the natural environment at synchronous altitudes, are summarized. Launch procedures, orbit alignment, and eclipse seasons are reviewed. The spacecraft configuration and subsystems are described. Catastrophic payload failures are reported: the SC6 (AFGL Thermal Plasma Analyzer) failed due to an excessive power draw in the electron step generator. The SC7 (NASA/MSFC Light Ion Mass Spectrometer) internal power supply failed. Lesser payload failures, including SC2 probe biasing, SC4-1 pulsed mode, and SC4-2 neutralizer are discussed. N.W.

**N82-14239*#** Aerospace Corp., El Segundo, Calif.
**ELECTRON ANGULAR DISTRIBUTIONS DURING CHARGING EVENTS**
J. F. Fennell, D. R. Croley, Jr., P. F. Mizera, and J. D. Richardson *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 370-385 refs (For primary document see N82-14213 05-18)
(Contract F04701-80-C-0081)
Avail: NTIS HC A99/MF A1 CSCL 22B

The angular distribution of electrons and ions at times of spacecraft charging were examined for several charging events. Generally it was found that electrons measured perpendicular to the Earth's magnetic field are more intense and more energetic than those measured parallel to the magnetic field during charging events. During the substorm charging injection, the electron spectra harden at all angles to the magnetic field as the evolution of the charging spectra is monitored by the P78-2 satellites. An example of the onset of charging and the changes in the electron distributions is examined. The evolution of the electrons from a 'soft' plasma sheet distribution to a 'hard' charging distribution is compared with the charging of Kapton on the satellite and the spacecraft frame potential. The ions are used to determine the spacecraft potential. Evidence of periodic surface potential variations related to particle anisotropies are presented and discussed. N.W.

**N82-14240*#** Panametrics, Inc., Waltham, Mass.
**OPERATION OF SC5 RAPID SCAN PARTICLE SPECTROMETER ON SCATHA SATELLITE**
Frederick A. Hanser, Bach Sellers, David A. Hardy, H. A. Cohen, J. Feynman, and M. S. Gussenhoven *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 386-411 refs Prepared in cooperation with AFGL and Boston Coll. (For primary document see N82-14213 05-18)
(Contracts F19628-79-C-0099; F19628-79-C-0031)
Avail: NTIS HC A99/MF A01 CSCL 22B

The SC5 rapid scan particle spectrometer, operating on the SCATHA satellite, is discussed. SC5 in-orbit operation and reduction of electrostatic analyzer (ESA) spectra are addressed. ESA data summaries from ion and electron gun operations are explained. Data from gun operations show how the satellite potential responds and provide information on the various time constants involved. N.W.

**N82-14241*#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**REVIEW OF HOT PLASMA COMPOSITION NEAR GEOSYNCHRONOUS ALTITUDE**
Richard G. Johnson *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 412-432 refs Prepared in cooperation with Bern Univ. (For primary document see

N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The information available on the hot plasma composition at and near the geostationary satellite orbit has increased dramatically during the past four years. At energies below 32 keV, ions of terrestrial origin, O(+) and He(+) are frequently observed to be significant contributors to the hot plasma density and energy density, and during geomagnetically disturbed periods, O(+) ions are typically the dominant hot plasma ions. Evidence for a solar cycle dependence to the O(+) hot plasma densities at the geostationary orbit has been found. Our understanding of the details of the physical processes involved in the entry, acceleration, transport, and loss of the plasma ions, and thus our ability to model them, is still quite limited. N.W.

**N82-14242*#** Lockheed Missiles and Space Co., Palo Alto, Calif.
**SCATHA OBSERVATIONS OF SPACE PLASMA COMPOSITION DURING A SPACECRAFT CHARGING EVENT**
R. G. Johnson, R. Strangeway, S. Kaye, R. Sharp, and E. Shelley *In* NASA. Lewis Research Center Spacecraft Charging Technol: 1980 Oct. 1980 p 433-438 refs (For primary document see N82-14213 05-18)
(Contract N00014-76-C-0444)
Avail: NTIS HC A99/MF A01 CSCL 22B

During an Earth eclipse of the SCATHA spacecraft, the spacecraft charged to potentials greater than 1KV for about 30 minutes with extended excursions greater than 4KV. The composition of the hot plasma was obtained in the 0.1 to 32 keV energy range with an ion mass spectrometer aboard the spacecraft. Prior to the onset of the charging event, H(+) was the principal plasma ion, and during the event O(+) was the principal ion. The composition was energy dependent and varied significantly on a time scale of 4 minutes. An assumption that the ion flux was all H(+) led to computed number densities that were in error by more than a factor of two for several time intervals during the event. S.L.

**N82-14243*#** Aerospace Corp., El Segundo, Calif.
**P78-2 ENGINEERING OVERVIEW**
A. L. Vampola *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 439-460 refs (For primary document see N82-14213 05-18)
(Contract F04701-80-C-0080)
Avail: NTIS HC A99/MF A01 CSCL 22B

Data from the P78-2 spacecraft are being used in verifying and validating analytical tools being developed for the design of spacecraft, such as NASCAP, for updating Military Standard 1541, for investigation of materials contamination, and for a study of the physics of charging. The analysis of this data has already resulted in changes in laboratory testing procedures, in a better understanding of some properties of materials exposed to the space environment, and in some insight into the EMI caused by discharges on spacecraft in a plasma environment. Some examples of early results from the engineering experiments are presented. Author

**N82-14244*#** Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
**SATELLITE SURFACE POTENTIAL SURVEY**
Paul F. Mizera and G. M. Boyd *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 461-469 refs (For primary document see N82-14213 05-18)
(Contract F04701-79-C-0080)
Avail: NTIS HC A99/MF A01 CSCL 22B

Results of Kapton differential voltage charging of the satellite surface potential monitor Kapton samples are presented for the first 100 days of P78-2 operations. Daily charging occurrences are plotted in magnetic local time and L-shell (altitude and magnetic latitude) space as a function of magnetic activity. Most of the low level charging occurs well into the dawn local time sector whereas the highest voltage levels occur in the premidnight local time sector. The probabilities of differential charging are extremely dependent on the local time sector, the altitude (or L-shell) and of course, the magnetic activity. A.R.H.

**N82-14245*#** SRI International Corp., Menlo Park, Calif.
**PRELIMINARY ANALYSIS OF DATA FROM SRI INTERNATIONAL TRANSIENT PULSE MONITOR ON BOARD P78-2 SCATHA SATELLITE**
S. A. Damron, R. C. Adamo, and J. E. Nanevicz *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 470-477 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The satellite charging at high altitudes (SCATHA) program addresses the occurrence of electrostatic discharges causing undesirable effects like deleterious transients in electronic circuits on satellites. The high altitude plasma environment and the effects of the interaction of this environment with the orbiting satellite are studied. The SRI transient pulse monitor (TPM) detects the transient electromagnetic signals induced in selected circuits. As a transient detector the TPM records transient signals, indicates the number of transients observed, and gives peak amplitude of the largest transient during each second's interval. Most of the early data from the TPM contain pulses associated with internal electrical activity and electrostatic charging on the surface of the P78-2 is evidenced. It is found that periods of external discharging do not necessarily coincide with periods in which high potentials are measured on the satellite's surface. E.A.K.

**N82-14246*#** Aerospace Corp., El Segundo, Calif.
**ASPECT DEPENDENCE AND FREQUENCY SPECTRUM OF ELECTRICAL DISCHARGES ON THE P78-2 (SCATHA) SATELLITE**
Harry C. Koons *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 478-492 refs (For primary document see N82-14213 05-18)
(Contract F04701-80-C-0081)
Avail: NTIS HC A99/MF A01 CSCL 22B

The satellite charging at high altitudes (SCATHA) P78-2 satellite payload includes a charging electrical effects analyzer (CEEA) which measures the characteristics of electrical discharges in both the frequency and time domain. Pulses are detected in response to commands during electron and ion beam operations and during natural discharge events. The pulse analyzer measures the shape of pulses on four sensors and is the primary CEEA diagnostic for the natural discharges. Only five discharges were found in the data at a time when the pulse analyzer was in mode with sufficient time resolution to resolve the frequency components in the waveform. E.A.K.

**N82-14247*#** Aerospace Corp., El Segundo, Calif.
**FLIGHT EVIDENCE OF SPACECRAFT SURFACE CONTAMINATION RATE ENHANCEMENT BY SPACECRAFT CHARGING OBTAINED WITH A QUARTZ CRYSTAL MICROBALANCE**
D. M. Clark and David F. Hall *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 493-508 refs (For primary document see N82-14213 05-18)
(Contract F04701-80-C-0081)
Avail: NTIS HC A99/MF A01 CSCL 22B

The significance of the fraction of the mass outgassed by a negatively charged space vehicle which is ionized within the vehicle plasma sheath and electrostatically reattracted to the space vehicle was determined. The ML-12 retarding potential analyzer/temperature controlled quartz crystal microbalances (RPA/TQCMs) distinguishes between charged and neutral molecules and investigates contamination mass transport mechanism. Two long term, quick look flight data sets indicate that on the average a significant fraction of mass arriving at one RPA/TQCM is ionized. It is assumed that vehicle frame charging during these periods was approximately uniformly distributed in degree and frequency. It is shown that electrostatic reattraction of ionized molecules is an important contamination mechanism at and near geosynchronous altitudes. E.A.K.

**N82-14248*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**P78-2 SATELLITE AND PAYLOAD RESPONSES TO ELECTRON BEAM OPERATIONS ON MARCH 30, 1979**
H. A. Cohen (AFGL), R. C. Adamo (SRI International), T. Aggson, A. Chesley (AFGL), D. M. Clark (Aerospace Corp.), S. A. Damron (SRI International), D. E. Delorey (Boston Coll.), J. F. Fennell (Aerospace Corp.), M. S. Gussenhoven (Boston Coll.), F. A. Hanser (Panametrics, Inc.) et al *In* NASA. Lewis Research Center

Spacecraft Charging Technol., 1980 Oct. 1980 p 509-559 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The operating modes of the SC4-1 payload, the resultant charging of the spacecraft frame and sample materials on the spacecraft exterior and recorded transient pulses are reported. Arcing was detected by pulse monitors in several electron beam modes of operation. The ejection of a beam of 6 mA of 3 keV electrons caused three distinct payload failures and created a transient problem in the telemetry system. The exact time, nature, and cause of these failures was determined and component failure and why they failed was identified. Analytical and modeling techniques are used to examine possible spacecraft and payload responses to the electron beam ejection which might have contributed to the arcing and payload failures. E.A.K.

**N82-14249*#** Systems Science and Software, La Jolla, Calif.
**REPRESENTATION AND MATERIAL CHARGING RESPONSE OF GEOPLASMA ENVIRONMENTS**
P. R. Stannard, G. W. Schnuelle, I. Katz, and M. J. Mandell *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 560-579 refs (For primary document see N82-14213 05-18)
(Contract NAS3-21762)
Avail: NTIS HC A99/MF A01 CSCL 22B

The sensitivity of the charging response to the representation of the measured environments and material properties are discussed. Single and double Maxwellian representations are compared with direct numerical integration of the observed spectra. The effect of anisotropic incident flux distribution is modeled. In addition, the effect of the high energy radiation upon bulk conductivity and hence differential charging is examined. E.A.K.

**N82-14250*#** Systems Science and Software, La Jolla, Calif.
**SIMULATION OF CHARGING RESPONSE OF SCATHA (P78-2) SATELLITE**
G. W. Schnuelle, P. R. Stannard, I. Katz, and M. J. Mandell *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 580-591 refs (For primary document see N82-14213 05-18)
(Contract NAS3-21762)
Avail: NTIS HC A99/MF A01 CSCL 22B

A model of the satellite charging at high altitudes (SCATHA P78-2) satellite was used to simulate the charging response of SCATHA at geosynchronous orbit. The model includes a description of the geometry, currents to exposed surface materials, and electrical connections on the spacecraft. The charging response of the vehicle to that predicted by the NASCAP model for the Day 87, 1979 eclipse charging event, in which the spacecraft charged to several kilovolts negative during a magnetospheric substorm are compared. Double Maxwellian representations of the plasma environment reproduce the charging response observed experimentally. E.A.K.

**N82-14251*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SCATHA SSPM CHARGING RESPONSE: NASCAP PREDICTIONS COMPARED WITH DATA**
Carolyn K. Purvis and John Staskus *In its* Spacecraft Charging Technol., 1980 Oct. 1980 p 592-607 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Models for the satellite surface potential monitor (SSPM) units constructed in the NASCAP code and the results of comparing predictions to surface voltage and baseplate current data are reported. Several peculiarities in the test data are noted. Preliminary results from space simulations of a SCATHA model with environments representative of the day 87, 1979, eclipse injection event are presented, and their implications for predicting space response are discussed. E.A.K.

**N82-14252*#** Boston Coll., Chestnut Hill, Mass.
**THREE-DIMENSIONAL ANALYSIS OF CHARGING EVENTS ON DAYS 87 AND 114, 1979, FROM SCATHA**
N. A. Saflekos, M. F. Tautz (Radex Corp.), A. G. Rubin (AFGL), D. A. Hardy (AFGL), P. F. Mizera (Aerospace Corp.), and J. Feynman *In* NASA. Lewis Research Center Spacecraft Charging Tecnol., 1980 Oct. 1980 p 608-631 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Angular distributions of ions and electrons from the Spacecraft Charging at High Altitudes (SCATHA) were investigated for the floating potential and the differential charging of the spacecraft as deduced from Liouville's theorem. The following was found: (1) short time charging events on the spacecraft are associated with short time increases of the intensity of 10 keV to 1 MeV electrons; (2) short time changes of the spacecraft differential potential are associated with simultaneous short time changes of the spacecraft floating potential; (3) solar UV intensities in penumbra anticorrelate with the spacecraft floating potentials; (4) NASCAP predicts correct forms of sunshade asymmetric surface potentials; (5) certain enhancements of the intensity of energetic ions diminishes the absolute value of the spacecraft surface potential; (6) spacecraft discharging events in times shorter than 20 sec did not change in the spectrum of the energetic plasma; (7) partial discharging of the spacecraft occurred upon entry into a magnetically depleted region; and (8) steady state potentials and transient potentials of duration less than 30 seconds are simulated by the NASCAP code. E.A.K.

**N82-14253*#** Air Force Geophysics Lab., Hanscom AFB, Mass.
**COMPUTER SIMULATION OF SPACECRAFT CHARGING ON SCATHA**
A. G. Rubin, H. A. Cohen, D. A. Hardy, M. F. Tautz (Radex Corp.), and N. A. Saflekos (Boston Coll.) *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 632-641 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Computer simulation to determine spacecraft charging on P78-2 (SCATHA) during a substorm and for modeling the effects of electron beam emission on the P78-2 ground potential for a variety of beam voltages and currents was used. Measured and computed spacecraft potentials are obtained to within several hundred eV. Computation of the electron beam emission effects on the spacecraft ground potential are shown. It is concluded that the spacecraft ground potential can be controlled by emitting an electron beam E.A.K.

**N82-14254*#** Boston Coll., Chestnut Hill, Mass.
**ANALYSIS OF AMBIENT AND BEAM PARTICLE CHARACTERISTICS DURING THE EJECTION OF AN ELECTRON BEAM FROM A SATELLITE IN NEAR-GEOSYNCHRONOUS ORBIT ON MARCH 30, 1979**
M. S. Gussenhoven, H. A. Cohen, D. A. Hardy, W. J. Burke, and A. Chesley *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 642-664 refs Prepared in cooperation with AFGL (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

An electron beam system was operated over a wide range of beam currents and energies for periods both in sunlight and in eclipse. Complex pitch angle modulations of the electron spectra are separately decomposed for each beam operation. When electrons are emitted perpendicular to the magnetic field with an energy of 3 keV and a current of 0.10 mA they return as a coherent beam only to the parallel detector. Throughout the beam operations the pitch angle distributions show electrons with energy less than beam energy streaming along the field line. Analytic expressions for the satellite electric field are constructed and particle trajectories are determined. E.A.K.

**N82-14255*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**COMPARISON OF NASCAP MODELLING RESULTS WITH LUMPED CIRCUIT ANALYSIS**
David B. Stang and Carolyn K. Purvis *In its* Spacecraft Charging Technol., 1980 Oct. 1980 p 665-683 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Engineering design tools that can be used to predict the development of absolute and differential potentials by realistic spacecra:, under geomagnetic substorm conditions are described. Two types of analyses are in use: (1) the NASCAP code, which computes quasistatic charging of geometrically complex objects with multiple surface materials in three dimensions; (2) lumped

element equivalent circuit models that are used for analyses of particular spacecraft. The equivalent circuit models require very little computation time, however, they cannot account for effects, such as the formation of potential barriers, that are inherently multidimensional. Steady state potentials of structure and insulation are compared with those resulting from the equivalent circuit model. E.A.K.

**N82-14256*#** TRW Defense and Space Systems Group, Redondo Beach, Calif.
**NASCAP CHARGING CALCULATIONS FOR A SYNCHRONOUS ORBIT SATELLITE**
N. L. Sanders and G. T. Inouye *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 684-708 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The use of the NASA Charging Analyzer Program (NASCAP) for the computation of spacecraft charge up in the energetic plasma environment of geosynchronous orbits is described. Spacecraft modelling, materials parameters, and NASCAP charging analyses are described. The synchronous orbit plasma environment used in the stress analysis employs a two Maxwellian energy distribution to determine the fluxes. Several NASCAP runs performed to determine the location and magnitude of environmentally induced voltage stresses are analyzed. J.D.H.

**N82-14257#** York Univ., Toronto (Ontario). Dept. of Physics.
**RESULTS FROM A TWO DIMENSIONAL SPACECRAFT CHARGING SIMULATION AND COMPARISON WITH A SURFACE PHOTOCURRENT MODEL**
J. G. Laframboise, S. M. L. Prokopenko, M. Kamitsuma, and R. Govard *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 709-716 refs (For primary document see N82-14213 05-18)
(Grant AF-AFOSR-2962-76)
Avail: NTIS HC A99/MF A01 CSCL 22B

A two dimensional spacecraft charging simulation program called CYLVIA, which treats infinite cylindrical geometries with angle dependence, is considered. Two features of this program, its orbit integration and current collection methods, are discussed. A calculation is presented of floating potentials of a spacecraft cross section which is represented by two conductive sectors, and a comparison is made between the photoemission current distribution obtained therein and another given by an approximate analytic surface photocurrent expression by Laframboise and Whipple. Author

**N82-14258*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ANALYTICAL MODELING OF SATELLITES IN GEOSYNCHRONOUS ENVIRONMENT**
N. John Stevens *In its* Space Charging Technol., 1980 Oct. 1980 p 717-729 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

Experiences with surface charging of geosynchronous satellites are reviewed and mechanisms leading to discharges on satellite surfaces are considered. It was found that the large differential voltages between the surface and the substrate required to produce massive laboratory discharges do not occur on satellites in space. Analytical modeling predictions supported by dielectric charging data from P78-2, SCATHA (Spacecraft Charging at High Altitudes) flight results are discussed. Ungrounded insulator areas, buried charge layers (due to mid-energy range particles), and positive differential voltages (where structure voltages are less negative than surrounding dielectric surface voltages) are considered as possible mechanisms producing satellite charge up. J.D.H.

**N82-14259*#** Systems Science and Software, San Diego, Calif.
**CALCULATION OF SURFACE CURRENT RESPONSE TO SURFACE FLASHOVER OF A LARGE SAMPLE UNDER GROUNDED AND FLOATING CONDITIONS**
M. J. Mandell, I. Katz, and G. W. Schnuelle *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 730-744 refs (For primary document see N82-14213 05-18)
(Contracts DNA001-79-C-0079; DNA001-79-C-0027)
Avail: NTIS HC A99/MF A01 CSCL 22B

Results for the electromagnetic response to the discharge of an 80 cm diameter dielectric sample mounted on a 120 cm diameter cylinder are presented. It is assumed that the dielectric is charged with a known potential profile dropping sharply near the edge, and the substrate initially grounded. During the early part of the discharge (approximately 10 ns) there is little difference between the grounded and floating cases. Beyond about 10 ns the grounded experiment is in approximate steady state, continuous to blow off charge until the dielectric is substantially discharged. The floating case, however, shows modestly decreasing emission and response. Eventually, a quasi-steady state is reached in which charge is transported from dielectric to substrate rather than blown off. J.D.H.

**N82-14260*#** JAYCOR, Alexandria, Va.
**MODEL OF COUPLING DISCHARGES INTO SPACECRAFT STRUCTURES**
A. J. Woods, M. J. Treadway, R. Grismore, R. E. Leadon, T. M. Flanagan, and E. P. Wenaas *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 745-754 refs Sponsored by AFWL (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The calculated results of a semiempirical model for electron-caused electromagnetic pulse (ECEMP) are compared to the experimental data for three spacecraft geometries. The appropriateness of certain model assumptions which have been employed in the absence of a microscopic theory for dielectric breakdown and associated electron blowoff is discussed. Results are limited to the exterior response of spacecraft structures, although neither the model nor the experiments were limited to the outside problem. Rationales for model assumptions are provided. J.D.H.

**N82-14261*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**DISAPPEARANCE AND REAPPEARANCE OF PARTICLES OF ENERGIES < 50 keV AS SEEN BY P78-2 (SCATHA) NEAR GEOSYNCHRONOUS ORBIT**
J. Feynman (Boston Coll.), N. A. Saflekos (Boston Coll.), H. G. Garrett, D. A. Hardy (AFGL), and E. G. Mullen *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 755-767 refs (For primary document see N82-14213 05-18)
(Contract F19628-79-C-0031)
Avail: NTIS HC A99/MF A01 CSCL 22B

The nightside particle environment as observed by the AFGL Rapid Scan Particle Detector on SCATHA showing large, sudden simultaneous changes in the fluxes of electrons and protons with energies above 50 keV (dropouts) is considered. An interesting feature of SCATHA dropouts is the quasiperiodic behavior of the particle flux amplitudes which often vary with a period of the order of 15 minutes both during the dropout and after the return. A flux return during eclipse caused a major spacecraft charging event of several kilovolts. The SCATHA observations are compared with those reported for other geosynchronous satellites. In agreement with ATS-5, a marked dependence in the frequency of occurrence due to an effect of the orbit is found. ATS-5 experienced few dropouts during quiet geomagnetic conditions. However, for an L shell greater than seven, SCATHA particle dropouts occur routinely during quiet conditions. Thus, for SCATHA's orbit, both the orbital position and geomagnetic conditions must be taken into account in evaluating the potential hazard of flux returns. J.D.H.

**N82-14262*#** Aerospace Corp., El Segundo, Calif.
**MILITARY STANDARDS AND SCATHA PROGRAM UPDATE OF MIL-STD-1541**
D. T. Frankos *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 768-788 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The elctromagnetic compatability requirements for space systems, 15 October 1973, to be met by industry contractors for spacecraft launch vehicles and other special space systems, are considered. Deficiencies in the existing standard with respect to spacecraft charge and discharge phenomena, the technical ramifications for generating a new standard, and the upgrading of MIL-STD-1541 with requirements supplied as a result of the SCATHA program are discussed. J.D.H.

**N82-14263*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**USE OF CHARGING CONTROL GUIDELINES FOR GEOSYNCHRONOUS SATELLITE DESIGN STUDIES**

N. John Steves *In its* Spacecraft Charging Technol., 1980 Oct. 1980 p 789-801 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

Several of the principle guidelines from the Spacecraft Charging Design Guidelines Handbook are presented with illustrative examples. Use of the geomagnetic substorm specification to qualify satellite designs, the evaluation of satellite designs by using analytical modelling techniques, the use of selected materials and coatings to minimize charging, the tying of all conducting elements to a common ground, and the use of electrical filtering to protect circuits from discharge induced upsets are discussed. Discharge criteria and SCATHA data are excluded. J.D.H.

**N82-14264*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**P78-2 SCATHA ENVIRONMENTAL DATA ATLAS**

E. Gary Mulen (AFGL), David A. Hardy (AFGL), Henry B. Garrett, and Elden C. Whipple (California Univ., San Diego) *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 802-813 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

The 100 eV to approximately 1 MeV plasma environment encountered by the P78-2 Spacecraft Charging at High Altitudes (SCATHA) satellite during its initial operation period was studied. Forty-four days of 10 minute averages of the four moments of the electron and ion distribution functions calculated from the SC5 and SC9 energetic particle measurements were analyzed to determine occurrence frequency, local time variation, geomagnetic activity variation, and L shell variation. The single and double Maxwellian parameters derived from the four moments were similarly analyzed. The interrelationships between the moments and derived parameters were computed and the results compared with the ATS-5 and ATS-6 atlas. Results of this analysis establish a baseline range for the SCATHA plasma environment. Author

**N82-14265*#** European Space Agency, Paris (France).

**METEOSAT SPACECRAFT CHARGING INVESTIGATION**

Dierk G. Hoge *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 814-834 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

A number of phenomena observed on the first orbiting Meteosat satellite attributed to spacecraft charging effects are considered. Design analysis, correlation of anomalies with space environmental data, on ground tests with an engineering model spacecraft, tests on the validity of improvements, and installation of suitable monitors for the second improved flight satellite are discussed. J.D.H.

**N82-14266*#** European Space Agency, Paris (France).

**ELECTRON IRRADIATION TESTS ON EUROPEAN METEOROLOGICAL SATELLITE**

J. Reddy *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 835-855 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

The observation of in orbit anomalies on Meteosat resulted in a test being performed to establish the charging and discharging characteristics of a flight configured engineering model when irradiated with electrons. Surface potentials were measured together with discharge rates and amplitudes. Results indicate that a large number of discharges are possible on the satellite whether or not the external surfaces are grounded. Initial measurements show that there are very high potential gradients around the satellite which obviously contribute largely to the discharging behavior. The time constant for charging is very small, indicating also that equilibrium conditions are achieved very quickly as the local ambient changes in orbit. A.R.H.

**N82-14267*#** Defense Nuclear Agency, Washington, D.C.

**SPACECRAFT CHARGING TECHNOLOGY IN THE SATELLITE X-RAY TEST FACILITY**

Troy J. Sponaugle *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 856-865 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

A satellite X-ray test facility (SXTF) is planned for studying system generated electromagnetic pulse effects on full scale, operational spacecraft. The environment created by a distant, high altitude nuclear burst can be simulated using pulsed X-ray sources. The facility is to be installed in a thermal vacuum chamber with dimensions greater then 10 m diameter and 20 m height and equipped with solar simulators and equipment for simulating the charging environment of space. The spacecraft charging system consists of several low energy electron and hydrogen ion sources (5-25 keV), one or two medium energy electron accelerators (150-300 keV), an array of vacuum ultraviolet lamps, and geomagnetic field suppression coils. Military, scientific, and commercial spacecraft can be tested before launching into the radiation environment of space. construction of SXTF is scheduled to begin in 1982 and the facility should be available for general use in 1984. Potential users are encouraged to express their needs for specific testing environments in SXTF. A.R.H.

**N82-14268*#** Spire Corp., Bedford, Mass.

**SIMULATION OF SPACECRAFT CHARGING ENVIRONMENTS BY MONOENERGETIC BEAMS**

Ward Halverson *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 866-886 refs Sponsored by AFGL (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

To simulate the distributed spectra of plasmas in space, the differential current density spectrum of the plasma was divided into a number of energy bands and the beam energy and current were calculated for each band to provide a piecewise reproduction of the distributed spectrum. Beam energies and current densities were chosen to match the velocity moments of the plasma distribution function. The velocity moments are averages related to physical quantities such as particle density, flux, pressure, and energy flux, and have been used extensively to characterize the measured properties of plasmas in space. Combinations of one, two, and three beams were found to match two to six velocity moments of Maxwellian distributions. A computational model was used to compare the charging of a spacecraft by plasmas with distributed spectra and by monoenergetic beams. A.R.H.

**N82-14269*#** California Univ., San Diego. Center for Astrophysics and Space Science.

**IMPORTANCE OF DIFFERENTIAL CHARGING FOR CONTROLLING BOTH NATURAL AND INDUCED VEHICLE POTENTIALS ON ATS-5 AND ATS-6**

E. C. Whipple and R. C. Olsen *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 888-893 refs (For primary document see N82-14213 05-18)

Avail: NTIS HC A99/MF A01 CSCL 22B

Three techniques of discharging satellites used on the P78-2 satellite were the ejection of a beam of electrons from an electron gun; the emission of electrons from a heated, biased filament; and the ejection of a plasma containing energetic positive xenon ions and low energy electrons. When the P78-2 satellite ground to plasma potential difference reached several hundred volts, each of the three techniques was able to completely discharge the satellite. The comparative effctiveness of the techniques were clearly shown. Two days later, the satellite charged to -8 keV upon entering eclipse. The electron gun, emitting 1 mA of electrons with 150 eV energy, reduced the difference in potential between satellite ground and the ambient plasma to -1 kV, but could not completely discharge the satellite. The plasma source completely discharged the satellite. A.R.H.

**N82-14270*#** SRI International Corp., Menlo Park, Calif.

**ELECTROMAGNETIC FIELDS PRODUCED BY SIMULATED SPACECRAFT DISCHARGES**

J. E. Nonevicz, R. C. Adamo (Beers Associates, Inc.), B. L. Beers, and T. N. Delmer (Beers Associates, Inc.) *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980

p 894-911 refs Sponsored by Air Force (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

The initial phase of a broader, more complete program for the characterization of electrical breakdowns on spacecraft insulating materials is described which consisted of the development of a discharge simulator and characterization facility and the performance of a limited number of discharge measurements to verify the operation of the laboratory setup and to provide preliminary discharge transient field data. A preliminary model of the electromagnetic characteristics of the discharge was developed. It is based upon the 'blow off' current model of discharges, with the underlying assumption of a propagating discharge. The laboratory test facility and discharge characterization instrumentation are discussed and the general results of the 'quick look' tests are described on quartz solar reflectors aluminized Kapton and silver coated Teflon are described. A.R.H.

**N82-14271*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**AGREEMENT FOR NASA/OAST - USAF/AFSC SPACE INTERDEPENDENCY ON SPACECRAFT ENVIRONMENT INTERACTION**
C. P. Pike (AFGL) and N. John Stevens *In its* Spacecraft Charging Technol., 1980 Oct. 1980 p 912-930 refs (For primary document see N82-14213 05-18)
Avail: NTIS HC A99/MF A01 CSCL 22B

A joint AF/NASA comprehensive program on spacecraft environment interactions consists of combined contractual and in house efforts aimed at understanding spacecraft environment ineraction phenomena and relating ground test results to space conditions. Activities include: (1) a concerted effort to identify project related environmental interactions; (2) a materials investigation to measure the basic properties of materials and develop or modify materials as needed; and (3) a ground simulation investigation to evaluate basic plasma interaction phenomena and provide inputs to the analytical modeling investigation. Systems performance is evaluated by both ground tests and analysis. There is an environmental impact investigation to determine the effect of future large spacecraft on the charged particle environment. Space flight investigations are planned to verify the results. The products of this program are test standards and design guidelines which summarize the technology, specify test criteria, and provide techniques to minimize or eliminate system interactions with the charged particle environment. A.R.H.

**N82-14272*#** Kansas Univ., Lawrence.
**NUMERICAL SIMULATION OF PLASMA INSULATOR INTERACTIONS IN SPACE. PART 1: THE SELF CONSISTENT CALCULATION**
J. H. Nonnast, R. C. Chaky, T. P. Armstrong, J. Enoch, and G. G. Wiseman *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 932-945 refs (For primary document see N82-14213 05-18)
(Grant NsG-3290)
Avail: NTIS HC A99/MF A01 CSCL 22B

A computer program is being developed to simulate the interaction of a plasma with a conducting disk partially covered by an insulator. Initial runs consider only charge sticking to the dielectric. Results indicate that the current density drawn by the hole in the dielectric increases approximately linearly with voltage for conductor voltages between 5 volts and 250 volts. Author

**N82-14273*#** Kansas Univ., Lawrence.
**NUMERICAL SIMULATION OF PLASMA INSULATOR INTERACTIONS IN SPACE. PART 2: DIELECTRIC EFFECTS**
R. C. Chaky, J. H. Nonnast, T. P. Armstrong, J. Enoch, and G. Wiseman *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 946-956 (For primary document see N82-14213 05-18)
(Grant NsG-3290)
Avail: NTIS HC A99/MF A01 CSCL 22B

Any process which may be modeled statistically for a simple plasma particle may be modeled by the particle in cell technique. The success of the calculation is then dependent on having a large enough number of particles that the statistical treatment is meaningful. Thus it is possible to include the effects of secondary emission, backscattering, charge sticking and possibly dielectric breakdown, photoemission, and spallation. The first plasma dielectric interaction included in the computer code for simulating plasma insulator interactions is secondary electron emission. A calculated current density vs. voltage curve is presented and compared to an experimental curve. A.R.H.

**N82-14274*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**THREE DIMENSIONAL SPACE CHARGE MODEL FOR LARGE HIGH VOLTAGE SATELLITES**
David Cooks (Rice Univ.), Lee W. Parker (Parker (Lee W.), Inc.), and James E. McCoy *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 957-978 refs (For primary document see N82-14213 05-18)
(Contract NAS9-16206)
Avail: NTIS HC A99/MF A01 CSCL 22B

High power solar arrays for satellite power systems with dimensions of kilometers, and with tens of kilovolts distributed over their surface face many plasma interaction problems that must be properly anticipated. In most cases, the effects cannot be adequately modeled without detailed knowledge of the plasma sheath structure and space charge effects. Two computer programs were developed to provide fully self consistent plasma sheath models in three dimensions as a result of efforts to model the experimental plasma sheath studies at NASA/JSC. Preliminary results indicate that for the conditions considered, the Child-Langmuir diode theory can provide a useful estimate of the plasma sheath thickness. The limitations of this conclusion are discussed. Some of the models presented exhibit the strong ion focusing observed in the JSC experiments. A.R.H.

**N82-14275*#** Systems Science and Software, San Diego, Calif.
**CHARGING OF A LARGE OBJECT IN LOW POLAR EARTH ORBIT**
D. E. Parks and I. Katz *In* NASA. Lewis Research Center Spacecraft Charging Technol., 1980 Oct. 1980 p 979-989 refs Sponsored in part by AFGL (For primary document see N82-14213 05-18)
(Contract NAS3-21762)
Avail: NTIS HC A99/MF A01 CSCL 22B

The charging of a large sphere subject to the environment encountered by the shuttle orbiter as it passes through the auroral regions in its low polar Earth orbit was investigated. The environment consists of a low temperature dense plasma and a relatively intense (200 mu A/sq m) field aligned flux of energetic electrons (approximately 5 to 10 keV). The potential on a sphere in eclipse is presented as a function of the ratio kappa of the charging rate produced by precipitating electrons to the discharging rate produced by ram ions. It was found that a 5 meter conducting sphere charges to potentials of order 1 kilovolt for kappa approximately 2, even though a 0.5 meter sphere charges to less than 100 volts. It is concluded that the natural charging environment can induce large potentials (approximately 1 kilovolt) on the shuttle orbiter. A.R.H.

**N82-14276*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INTERACTIVE DESIGN AND ANALYSIS OF FUTURE LARGE SPACECRAFT CONCEPTS**
L. Bernard Garrett Dec. 1981 32 p refs Presented at the 16th AIAA Thermophys. Conf., Palo Alto, Calif., 23-25 Jun. 1981
(NASA-TP-1937; L-14739) Avail: NTIS HC A03/MF A01 CSCL 22B

An interactive computer aided design program used to perform systems level design and analysis of large spacecraft concepts is presented. Emphasis is on rapid design, analysis of integrated spacecraft, and automatic spacecraft modeling for lattice structures. Capabilities and performance of multidiscipline applications modules, the executive and data management software, and grahics display features are reviewed. A single user at an interactive terminal create, design, analyze, and conduct parametric studies of Earth orbiting spacecraft with relative ease. Data generated in the design, analysis, and performance evaluation of an Earth-orbiting large diameter antenna satellite are used to illustrate current capabilities. Computer run time statistics for

the individual modules quantify the speed at which modeling, analysis, and design evaluation of integrated spacecraft concepts is accomplished in a user interactive computing environment.
E.A.K.

**N82-14277*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**THERMAL AND AEROTHERMAL PERFORMANCE OF A TITANIUM MULTIWALL THERMAL PROTECTION SYSTEM**
Don E. Avery, John L. Shideler, and Robert N. Stuckey (Johnson Space Center) Dec. 1981 59 p refs
(NASA-TP-1961; L-14719) Avail: NTIS HC A04/MF A01 CSCL 22B

A metallic thermal protection system (TPS) concept the multiwall designed for temperature and pressure at Shuttle body point 3140 where the maximum surface temperature is approximately 811 K was tested to evaluate thermal performance and structural integrity. A two tile model of titanium multiwall and a model consisting of a low temperature reusable surface insulation (LRSI) tiles were exposed to 25 simulated thermal and pressure Shuttle entry missions. The two systems performed the same, and neither system deteriorated during the tests. It is indicated that redesign of the multiwall tiles reduces tile thickness and/or weight. A nine tile model of titanium multiwal was tested for radiant heating and aerothermodynamics. Minor design changes that improve structural integrity without having a significant impact on the thermal protection ability of the titanium multiwall TPS are identified. The capability of a titanium multiwall thermal protection system to protect an aluminum surface during a Shuttle type entry trajectory at locations on the vehicle where the maximum surface temperature is below 811 K is demonstrated. E.A.K.

**N82-14129#** European Space Operations Center, Darmstadt (West Germany).
**SPACECRAFT FLIGHT DYNAMICS AT ESOC**
R. E. Muench *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 55-60 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14135#** National Aerospace Lab., Amsterdam (Netherlands).
**ESTIMATES OF SPACECRAFT ATTITUDE AND SENSOR PARAMETERS USING ADAPTIVE FILTERING: METEOSAT 1 TRANSFER ORBIT APPLICATION**
G. Moek and C. R. Traas (Technische Hogeschool, Twente, Netherlands) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 117-131 refs (For primary document see N82-14123 05-12)
(Contract ESTEC-3319/77)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14147#** Universite Catholique de Louvain (Belgium).
**PARTITIONING METHODS FOR IDENTIFICATION AND CONTROL OF FLEXIBLE SPACECRAFT**
G. Campion and P. Y. Willems *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 245-251 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14165#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**EAST-WEST STATIONKEEPING MANEUVER**
M. Utashima, A. Tanaka, T. Tohchi (Fujitsu Ltd.), and T. Ogino (Mitsubishi Electric Corp.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 407-415 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14170#** Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
**IN ORBIT CHECKOUT OF THE IRAS GYROSCOPES**
J. F. M. vanCasteren *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 451-459 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

**N82-14278*#** National Aeronautics and Space Administration, Washington, D. C.
**ATTITUDE MEASUREMENT: PRINCIPLES AND SENSORS**
P. Duchon and M. P. Vermande Nov. 1981 47 p Transl. into ENGLISH of "La Mesure d'Attitude, les Principes - les Sensors" France, 1980 p 315-348 Presented at Spacecraft Orbital Motion; Course in Space Technol., Toulouse, 2-13 Jun. 1980 Original language document was announced as A81-33388 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by CNES, France
(Contract NASw-3541)
(NASA-TM-76647) Avail: NTIS HC A03/MF A01 CSCL 22B

Tools used in the measurement of satellite attitude are described. Attention is given to the elements that characterize an attitude sensor, the references employed (stars, moon, Sun, Earth, magnetic fields, etc.), and the detectors (optical, magnetic, and inertial). Several examples of attitude sensors are described, including sun sensors, star sensors, earth sensors, triaxial magnetometers, and gyrometers. Finally, sensor combinations that make it possible to determine a complete attitude are considered; the SPOT attitude measurement system and a combined CCD star sensor-gyrometer system are discussed. Author

**N82-14279#** Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
**RICAR: PORTABLE TEST EQUIPMENT FOR THE INTEGRATION OF THE ISOPROBRE EXPERIMENT ON BOARD THE ARCAD 3 SATELLITE [RICAR: REFERENCE POUR INTERFACE COUPLEUR ARCAD. APPAREIL DE TEST PORTABLE POUR L'INTEGRATION DE L'EXPERIENCE ISOPROBE A BORD DU SATELLITE ARCAD 3]**
J. P. Dume, M. Leveque, and P. Fort 10 Jun. 1981 147 p In FRENCH
(CRPE-1078) Avail: NTIS HC A07/MF A01

Test equipment that substitutes for an onboard computer which operates a satellite sounding experiment was developed. Computer system functions are described and circuit diagrams are given. The test system performs two operations: it verifies experiment modules, localizing defects and it sends repetitive command sequences, detecting malfunctions which might be due to the satellite/experiment interface. Checkout procedures for satellite support and maintenance personnel are recommended.
Author (ESA)

**N82-14115#** Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
**THE PARTICULATE IMPACT ANALYZER, AN INSTRUMENT TO ANALYZE SMALL PARTICLES RELEASED BY HALLEY'S COMET**
J. Kissel *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 53-60 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14116#** Kent Univ., Canterbury (England). Space Sciences Lab.
**A DUST IMPACT DETECTION SYSTEM FOR THE GIOTTO HALLEY MISSION**
J. A. M. McDonnell, E. Gruen (Max-Planck Inst. fuer Kernphysik), G. C. Evans, J. G. Firth (Science Research Council, Chilton, Engl.), W. C. Carey, H. Kuczera (Technische Univ., Munich), W. M. Alexander (Baylor Univ., Waco, Tex.), D. H. Clark (Sciene Research Council, Chilton, Engl.), R. J. L. Grard (ESTEC, Noordwijk,

Netherlands), M. S. Hanner (JPL, Pasadena, Calif.) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 61-75 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14118#** Bern Univ. (Switzerland). Physikalisches Inst.
**THE GIOTTO ION MASS SPECTROMETER**
H. Balsiger, J. Geiss, D. T. Young, H. Rosenbauer (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), R. Schwenn (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), W.-H. Ip (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany), E. Ungstrup (Danish Space Research Inst.), M. Neugbauer (JPL, Pasadena, Calif.), R. Goldstein (JPL, Pasadena, Calif.), B. E. Goldstein (JPL, Pasadena, Calif.) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 93-98 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14121#** Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.
**THE HALLEY OPTICAL PROBE EXPERIMENT**
A.-C. Levasseur-Regourd, J. L. Weinberg (Lab. d'Astronomie, Marseille), F. Giovane (Lab. d'Astronomie, Marseille), D. W. Schuermann (Lab. d'Astronomie, Marseille), P. Lamy (Space Astronomy Lab., Gainesville, Florida), M. Festou (Space Astronomy Lab., Gainesville, Florida), J. L. Bertaux, R. Dumont, A. Llebaria, and R. H. Giese *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 121-126 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14122#** Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
**THE GIOTTO NEUTRAL MASS SPECTROMETER**
D. Krankowsky, P. Laemmerzahl, P. Eberhardt (Bern Univ.), U. Herrmann (Bern Univ.), J. J. Berthelier (CNRS, Paris), M. Sylvain (CNRS, Paris), J. H. Hoffman (Texas Univ., Dallas), R. R. Hodges (Texas Univ., Dallas), U. vonZahn (Bonn Univ.), H. U. Keller (Max-Planck Inst. fuer Aeronomie, Katlenburg-Lindau, West Germany) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 127-130 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14125#** European Space Operations Center, Darmstadt (West Germany).
**A SIRIO 2 LASER RANGING EXPERIMENT**
J. M. Dow and W. Flury *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 13-23 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

**N82-14280*#** Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
**PARAMETRIC ANALYSIS OF DIFFUSER REQUIREMENTS FOR HIGH EXPANSION RATIO SPACE ENGINE Final Report**
C. J. Wojciechowski and P. G. Anderson Nov. 1981 65 p refs
(Contract NAS8-33981)
(NASA-CR-161924; LMSC-HREC-TR-D784489) Avail: NTIS HC A04/MF A01 CSCL 21H

A supersonic diffuser ejector design computer program was developed. Using empirically modified one dimensional flow methods the diffuser ejector geometry is specified by the code. The design code results for calculations up to the end of the diffuser second throat were verified. Diffuser requirements for sea level testing of high expansion ratio space engines were defined. The feasibility of an ejector system using two commonly available turbojet engines feeding two variable area ratio ejectors was demonstrated. N.W.

**N82-14281*#** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**SOLAR CELL MODULES FOR PLASMA INTERACTION EVALUATION Final Report**
15 Oct. 1981 47 p refs
(Contract NAS8-34026)
(NASA-CR-161922; LMSC-D794945) Avail: NTIS HC A03/MF A01 CSCL 21C

A plasma interaction analysis in support of the solar electric propulsion subsystem examined the effects of a large high voltage solar array interacting with an ion thruster produced plasma. Two solar array test modules consisting of 36 large area wraparound contact solar cells welded to a flexible Kapton integrated circuit substrate were abricated. The modules contained certain features of the effects of insulation, din-holes, and bonding of the cell to the substrate and a ground plane. The possibility of a significant power loss occurring due to the collection of charged particles on the solar array interconnects was the focus of the research. R.J.F.

**N82-14282#** Calspan Field Services, Inc., Arnold Air Force Station, Tenn.
**A STUDY OF TEST TECHNIQUES FOR EVALUATING ABLATIVE PLASMA ENGINES IN VACUUM TEST CELLS Interim Report, 14 Apr. 1979 - 31 Dec. 1980**
R. Dawbarn, S. Steely, R. L. McGuire, and L. L. Price AEDC Oct. 1981 80 p refs Sponsored by Air Force
(AD-A105875; AEDC-TR-81-8) Avail: NTIS HC A05/MF A01 CSCL 14/2

The Teflon pulsed thruster is being considered as an attitude control and station-keeping device for spacecraft and satellites. In determining the compatibility of the pulsed plasma thruster with spacecraft systems, it is necessary to assess the potentially harmful effects the exhaust products may have on various spacecraft surfaces. Previous efforts to acquire data in space environmental chambers have had limited success due to the interferences caused by exhaust products scattering from the test facility walls and pumping panels. The overall objective of this effort is to define the operating characteristics of prototype pulsed plasma engine and a test facility configuration suitable for contamination-type tests. The immediate objectives of this report are: (1) to use a micropound and a millipound pulsed plasma engine to obtain information on the species in the plasma and how they react when they encounter the test chamber walls, and (2) to examine the effectiveness of possible diagnostic techniques; these include witness plates, electron multipliers, mass spectrometers, Faraday cups, attenuated total reflectance (ATR) plates, calorimeters, and UV spectroscopy. Author (GRA)

**N82-14164#** National Space Development Agency, Ibaraki (Japan). Tsukuba Space Center.
**OPTIMIZATION OF APOGEE KICK MOTOR (AKM) FIRING ATTITUDE**
M. Hirota, A. Tanaka, C. Abe (Fujitsu Ltd.), and T. Shimizu (Fujitsu Ltd.) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 399-406 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14172#** Engins Matra, Velizy (France).
**THRUSTOR PERFORMANCE MODELING AND PARAMETERS ESTIMATION**
P. E. Bourg *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 479-484 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

**N82-14283*#** National Aeronautics and Space Administration, Washington, D. C.
**AEROSIL FOR THE IMPROVEMENT OF THE FLOW BEHAVIOR OF POWDERED SUBSTANCES**
Dec. 1981 28 p refs Transl. into ENGLISH from Schriftenreihe Pigmente, Degussa, (Frankfurt), no. 31, 10 Aug. 1971 p 1-17 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-76643) Avail: NTIS HC A03/MF A01 CSCL 11G

The tendency of powdered substances to agglomerate and stick together is studied. The highly dispersed silicic acid Aerosil (tradename) is studied as an agent to improve the free flowing characteristics of powdered materials. It was concluded that the use of Aerosil 200, Aerosil R 972, aluminum oxide C and sylicic acid D 17 as flow agents caused broad improvements in the flow properties of powders. Additionally, the sifting, dispersion, and spray behavior, as well as the grinding and air separation characteristics of powders were improved. R.J.F.

# 24 COMPOSITE MATERIALS

Includes laminates.

**N82-14284#** Indian Inst. of Tech., Bombay. Dept. of Aeronautical Engineering.
**HAND-OPERATED HONEYCOMB CORE EXPANSION SET-UP**
N. K. Naik, Nitin Rameshchandra, and G. R. Shevare Sep 1981 16 p
(AE-TN-810901) Avail: NTIS HC A02/MF A01

Honeycomb sandwiches as a design concept and adhesive bonding as a joining process have been combined by unique designs and processes to produce extremely efficient structural configurations. An attempt to design and fabricate a simple hand operated laboratory based honeycomb core expansion set-up is described. Locally available adhesives and aluminum foils are used for preparing the slabs for expansion. A.R.H.

**N82-14285*#** National Aeronautics and Space Administration, Washington, D. C.
**BENDING FATIGUE TESTS ON SiC-AL TAPES UNDER ALTERNATING STRESS AT ROOM TEMPERATURE**
Johann Albrecht Herzog Nov. 1981 21 p refs Transl. into ENGLISH Z. fuer Metallk. (West Germany), v. 72, Mar. 1981 p 191-197 Original language document was announced as A81-27934 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-76631) Avail: NTIS HC A02/MF A01 CSCL 20K

The development of a testing method for fatigue tests on SiC-Al tapes containing a small amount of SiC filaments under alternating stress is reported. The fatigue strength curves resulting for this composite are discussed. They permit an estimate of its behavior under continuous stress and in combination with various other matrices, especially metal matrices. J.D.H.

**N82-14286*#** Boeing Aerospace Co., Seattle, Wash.
**DESIGN, FABRICATION AND TEST OF GRAPHITE/POLYIMIDE COMPOSITE JOINTS AND ATTACHMENTS FOR ADVANCED AEROSPACE VEHICLES Quarterly Technical Progress Report, 1 Dec. 1980 - 31 Mar. 1981**
J. B. Cushman Hampton, Va. NASA. Langley Research Center. Apr. 1981 47 p refs
(Contract NAS1-15644)
(NASA-CR-159114; QTPR-7) Avail: NTIS HC A03/MF A01 CSCL 11D

Standard and advanced bonded joint concepts were evaluated to develop a data base for the design and analysis of advanced composite joints for use at elevated temperatures (561K (550 F)). Design concepts for specific joint applications and the fundamental parameters controlling the static strength characteristics of such joints were identified. Test results are presented for rail shear and sandwich beam compression tests and tension tests of moisture conditioned specimens and bonded on 'T' sections. Coefficients of thermal expansion data are presented for A7F (LARC 13 Amide-imide modified) adhesion. Static discriminator test results for type 1 and type 2 bonded and bolted preliminary attachment concepts are presented and discussed. A.R.H.

**N82-14287*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**DURABILITY/LIFE OF FIBER COMPOSITES IN HYGRO-THERMOMECHANICAL ENVIRONMENTS**
C. C. Chamis and J. H. Sinclair 1981 28 p refs Presented at the Sixth Conf. on Composite Mater.: Testing and Design sponsored by the Am. Soc. for Testing and Mater., Phoenix, Ariz., 12-13 May 1981
(NASA-TM-82749; E-1065) Avail: NTIS HC A03/MF A01 CSCL 11D

Statistical analysis and multiple regression were used to determine and quantify the significant hygrothermomechanical variables which infuence the tensile durability/life (cycle loading, fatigue) of boron-fiber/epoxy-matrix (B/E) and high-modulus-fiber/epoxy-matrix (HMS/E) composites. The use of the multiple regression analysis reduced the variables from fifteen, assumed initially, to six or less with a probability of greater than 0.999. The reduced variables were used to derive predictive models for compression an intralaminar shear durability/life of B/E and HMS/E composites assuming isoparametric fatigue behavior. The predictive models were subsequently generalized to predict the durability/life of graphite-fiber-r generalized model is of simple form, predicts conservative values compared with measured data and should be adequate for use in preliminary designs. B.W.

**N82-14288*#** Wyoming Univ., Laramie. Composite Materials Research Group.
**ANALYSIS OF CRACK PROPAGATION AS AN ENERGY ABSORPTION MECHANISM IN METAL MATRIX COMPOSITES Interim Report, Sep. 1979 - Dec. 1980**
Donald F. Adams and Daniel P. Murphy Feb. 1981 159 p refs
(Grant NsG-3217)
(NASA-CR-165051; UWME-DR-101-102-1) Avail: NTIS HC A08/MF A01 CSCL 11D

The crack initiation and crack propagation capability was extended to the previously developed generalized plane strain, finite element micromechanics analysis. Also, an axisymmetric analysis was developed, which contains all of the general features of the plane analysis, including elastoplastic material behavior, temperature-dependent material properties, and crack propagation. These analyses were used to generate various example problems demonstrating the inelastic response of, and crack initiation and propagation in, a boron/aluminum composite. B.W.

**N82-14289#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
**COLLOQUIUM ON COMPOSITE MATERIALS [VERBUND-WERKSTOFFE: WERKSTOFF KOLLOQUIUM]**
1980 27 p refs In GERMAN Presented at Cologne, 3 Dec. 1980
Avail: NTIS HC A03/MF A01

Directionally solidified entectic composites are discussed as well as superalloys and the effects of a large temperature gradient on their structure; thermal fatigue; vapor deposition tests with Ni Co Gr Al Y alloys; solidification; oxidation behavior; protective layers are also considered. The fracture mechanics and microanalysis of fiber, and reinforced composites and the influence of a protective oxidation layer on the high temperature resistance of reaction bonded silicon nitride are also examined. For individual titles, see N82-14290 through N82-14295.

**N82-14290#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

**FRACTURE MECHANICS IN FIBER REINFORCED COMPOSITE MATERIALS, TAKING AS EXAMPLES B/Al AND CFRP [BRUCHMECHANIK AN FASERVERBUNDWERKSTOFFEN AM BEISPIEL VON B/Al UND CFK]**

P. W. M. Peters *In its* Colloq. on Composite Mater. 1980 2 p refs In GERMAN (For primary document see N82-14289 05-24)

Avail: NTIS HC A03/MF A01

The validity of linear elastic fracture mechanics and other fracture criteria was investigated with laminates of boron fiber reinforced aluminum (B/Al) and of carbon fiber reinforced epoxide (CFRP). Cracks are assessed by fracture strength Kc or Kmax (critical or maximum value of the stress intensity factor). The Whitney and Nuismer point stress criterium and average stress criterium often show that Kmax of fiber composite materials increases with increasing crack length; however, for B/Al and CFRP the curve showing fracture strength as a function of crack length is only applicable in a small domain. For B/Al, the reason is clearly the extension of the plastic zone (or the damage zone in the case of CFRP) which can not be described with a stress intensity factor. Author (ESA)

**N82-14291#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

**EFFECTS OF A LARGE TEMPERATURE GRADIENT ON THE STRUCTURE OF DIRECTIONALLY SOLIDIFIED EUTECTIC COMPOSITES AND SUPERALLOYS [EINFLUSS EINES HOHEN TEMPERATURGRADIENTEN AUF DAS GEFUEGE GERICHTET ERSTARRTER EUTEKTIKA UND SUPERLEGIERUNGEN]**

G. Staniek *In its* Colloq. on Composite Mater. 1980 3 p refs In GERMAN (For primary document see N82-14289 05-24)

Avail: NTIS HC A03/MF A01

An apparatus for high temperature tests of the structural stability of directionally solidified eutectic composites and superalloys was developed. It was used for cooled blades in high temperature gas turbines in which fast temperature changes and important temperature gradients occur. With this apparatus, a temperature gradient of a few hundred K/mm is obtained with a maximum of 1600 K. Structural instabilities due to mechanical stresses (cracks and plastic deformation) occur especially in superalloys, although some are decidedly stable. Instabilities due to thermal loads (coarsening, transformations, decomposition of phases, oxidation) are frequently observed, but test temperatures and gradients are considerably higher than in normal operation, so the employment of these alloys is not directly limited. Author (ESA)

**N82-14292#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

**VAPOR DEPOSITION TESTS WITH NiCoCrAlY ALLOYS: FIRST RESULTS FOR THE MECHANICAL HIGH TEMPERATURE CHARACTERISTICS OF THE COATED SUPERALLOY IN 738 LC [AUFDAMPFVERSUCHE MIT NiCoCrAlY-LEGIERUNG ERSTE ERGEBNISSE MECHANISCHER HOCHTEMPERATUR-EIGENSCHAFTEN VON BESCHICHTETEM IN 738 LC]**

S. Scheidt *In its* Colloq. on Composite Mater. 1980 2 p In GERMAN (For primary document see N82-14289 05-24)

Avail: NTIS HC A03/MF A01

The mechanical properties of directionally solidified IN738LC (j+j' superalloy), vapor coated with NiCoGrAlY (j+B alloy), were tested, in order to enhance the lifetime of turbine blades. The oxidation behavior of uncoated and coated samples is compared. Creep, fatigue, and accelerated life test results are presented and interpreted. The influence of sample preparation (cleaning, heating); treatment after the coating procedure on the coating structure and the arrest of coating and substrate (IN100 and others) are discussed. Author (ESA)

**N82-14293#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

**LABORATORY EXPERIENCE WITH DIRECTIONAL SOLIDIFICATION OF EUTECTIC HIGH TEMPERATURE ALLOYS [ERFAHRUNGEN BEI DER GERICHTETEN ERSTARRUNG VON EUTEKTISCHEN HT-LEGIERUNGEN IM LABOR]**

K. Fritscher, G. Staniek, and H. Mangers *In its* Colloq. on Composite Mater. 1980 2 p refs In GERMAN (For primary document see N82-14289 05-24)

Avail: NTIS HC A03/MF A01

The structure of five directionally solidified eutectic alloys was studied. Two structures (j/j'a and j/j' TaC) were found to be very regular, the others were found to deviate from the ideal structure (Co, Cr-Cr7 Cr3). The velocities at which the practically faultless eutectic structures are grown using the Bridgman technique, are given together with the average thermodynamic and constitutional values. Small differences in the entropy of fusion of the phases concerned and a possibly small difference in their chemical composition favor fast solidification. The susceptibility to defects during production and the necessary technological outlay strongly depend on the alloying system. Author (ESA)

**N82-14294#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

**MICROANALYSIS OF COMPOSITE MATERIALS [MIKROANALYSE AN VERBUNDWERKSTOFFEN]**

H. J. Dudek, G. Ziegler, R. Borath, and R. Leucht *In its* Colloq. on Composite Mater. 1980 2 p In GERMAN (For primary document see N82-14289 05-24)

Avail: NTIS HC A03/MF A01

Analysis methods that determine the chemical structure of the reaction zone, intervening in the adhesion between the components of fiber reinforced composite materials, are discussed for silicon carbide fiber reinforced titanium alloys. Both X-ray microanalysis, and Auger electron spectroscopy (AES) are suited for this analysis. On compact samples, AES allows a spatial resolution of up to 0.05 micron and, in combination with ion etching, it enables the demonstration of monatomic layers. The reaction zone in SiC Ti composites has a diameter of a few microns. The reaction between SiC and Ti predominantly leads to solving the fiber material. In the AES depth profile, concentrations of Si and 'C which can lead to the formation of hard phases are observed. Author (ESA)

**N82-14295#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

**OXIDATION BEHAVIOR OF DIRECTIONALLY SOLIDIFIED EUTECTIC COMPOSITES AS PROTOTYPES FOR THE DEVELOPMENT OF PROTECTIVE LAYERS [OXIDATIONSVERHALTEN VON GERICHTET ERSTARRTEN EUTEKTIKA UND DEREN MODELLCHARAKTER FUER DIE SCHUTZSCHICHTENTWICKLUNG]**

K. Fritscher, S. Scheidt, and H. Gedanitz *In its* Colloq. on Composite Mater. 1980 2 p In GERMAN (For primary document see N82-14289 05-24)

Avail: NTIS HC A03/MF A01

The structure of a NiCoGrAlY layer is compared with the structure of fibrous and lamellar directionally solidified eutectic composites. In all cases there exist two-phase structures with phase alignment. A comparatively strong similarity is observed between the structure of fibrous directionally solidified eutectic composites and the structure of vapor deposited NiCoCrAlY layers. The oxidation of fibrous eutectic composites is anisotropic: the phase alignment directly influences the oxidation velocity, whereby enhanced diffusion along the tubular phase boundary is assumed. Lamellar eutectic composites do not show this anisotropy since many phase boundaries are in contact with the oxidizing surface as well as in the direction of and perpendicular to the growth direction. Both types of eutectic composites basically show acceleration of oxidation when the distance between the phases decreases, enhancing the specific phase boundary surface. The results are discussed with regard to outlining protective layer systems. Author (ESA)

**N82-14296#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Laser Hardened Materials Branch.

**SYNTHESIS, CHARACTERIZATION AND OPTICAL PROPERTIES OF BARIUM TITANATE FILMS SPUTTERED UNDER VARIOUS CONDITIONS Final Report, 1 Apr. - 5 Dec. 1980**

John C. Olson, Donald F. Stevison, and Izhar Bransky Jun. 1981 75 p refs

(AF Proj. 2422)

(AD-A105655; AFWAL-TR-81-4049) Avail: NTIS HC A04/MF A01 CSCL 13/8

Data is presented on BaTiO3 films which were RF sputtered on Pt, quartz and sapphire substrates at various temperatures and gas mixtures. Measurements of density, dielectric constant, electrical conductivity, X-ray diffraction, energy band gap from optical absorption and wavelength, and temperature dependence of refractive index are presented. Measurements were also made on a BaTiO3 single crystal and a hot-pressed ceramic pellet for direct comparison of bulk properties to those of the films. The results of this work demonstrate that a transition of the properties occurs between the amorphous and crystalline states depending on the surface temperature during sputtering. The transition is sluggish up to 700 C above which crystalline properties of the films appear rapidly. Author (GRA)

**N82-14297#** California Univ., Berkeley. Dept. of Mechanical Engineering.

**A THEORY OF LAMINATED COMPOSITE PLATES AND RODS**

A. E. Green May 1981 66 p refs
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A105591; UCB/AM-81-3) Avail: NTIS HC A04/MF A01 CSCL 11/4

This paper is concerned with small deformations of a class of laminated layered composite plates and a class of laminated layered composite rods utilizing a direct formulation of thermomechanical theories of shells and rods. The paper is arranged in two parts, namely Part A (for laminated composite plates) and Part B (for laminated composite rods), and can be read independently of each other. In each part, after providing the main ingredients of a direct formulation, fairly general linear theories are developed which include both dynamical and thermal effects. Some applications to sandwich plates and layered rods are discussed in detail. Author (GRA)

**N82-14298#** Army Missile Command, Redstone Arsenal, Ala.

**WHOLE-FIELD EXPERIMENTAL STRESS ANALYSIS USING LASER SPECKLE INTERFEROMETRY**

Terry L. Vandiver 14 Feb. 1981 138 p refs
(AD-A105805; AD-E950170; DRSMI/RL-81-10-TR) Avail: NTIS HC A07/MF A01 CSCL 11/4

The objective of this study was to develop a whole-field experimental stress analysis method for composite structures. A data-gathering system, using the optical technique of laser speckle interferometry, was used to capture deformation of bodies under load on a film record. The speckle interferograms were analyzed by a computer-aided scanning system. A mathematical and geometrical interpretation of interferometric data is presented. The interferograms were analyzed at strategic image points on the test specimens to obtain displacement data which was used to calculate strains, shearing strains, and correlated with shearing stresses. Anisotropic elastic constants such as Young's modulus, shear modulus, and Poisson's ratio were calculated. A full-field aperture analysis was used as a tool to qualitatively observe the free edge effects of shear specimens. The techniques presented in this report are significant because full-field or discrete information can be obtained from any point rather than averaging data from a small region. Author (GRA)

**N82-14299#** California Univ., Livermore. Lawrence Livermore Lab.

**COMPOSITE FLYWHEEL DURABILITY AND LIFE EXPECTANCY: TEST PROGRAM**

S. V. Kulkarni, K. L. Reifsnider, and D. M. Boyd 14 Jul. 1981 13 p refs Presented at the DOE Passive and Hybrid Solar Energy Program Update, Washington, D.C., 24-26 Aug. 1981
(Contract W-7405-eng-48)
(DE81-028849; UCRL-86450; CONF-810832-5) Avail: NTIS HC A02/MF A01

A test program was designed to: determine the durability and life expectancy of flywheel rotors; identify critical performance and durability characteristics that control the long-term service and safety of rotors and rotor containments; and develop test procedures that can be used to economically evaluate the performance of flywheels under cyclic loading in the laboratory and to relate that information to long-term service behavior. Approximately half the project is complete, including the following tasks: a material property data base was assembled for each major material to be used in the flywheels; material property data was characterized and modeled; the initial version of a generic test program was designed; and some NDE characterization of all prototype composite flywheels rotors was conducted. DOE

**N82-14300#** Oak Ridge National Lab., Tenn.

**FRACTURE TOUGHNESS OF Al2O3-ZrO2 COMPOSITES**

P. F. Becher and V. J. Tennery 1981 17 p refs Presented at the Intern. Symp. on the Fracture Mech. of Ceramics University Park, Pa., 15 Jul. 1981
(Contract W-7405-eng-26)
(DE81-028575; CONF-810746-1) Avail: NTIS HC A02/MF A01

The fracture toughness K sub IC, of Al2O3-ZrO2 two-phase ceramic composites was determined for different ZrO2/Al2O3 ratios and selected Y2O3 stabilizer concentrations in the ZrO2. The double cantilever beam specimen geometry was used. In composites containing 20 vol % ZrO2, K sub IC increases with decrease in Y2O3 content from 3 to 1 mol %. On the other hand, composites containing 30 vol % ZrO2, decreasing Y2O3 additions from 3 to 2 mol % leads to a maximum in K sub IC value of about 6.2 MPa m (1/2) which occurred in a composition containing 2 mol % Y2O3. In this same composite, this maximum shifts to a value of about 8 MPa m (1/2) at about 2 to 3 mol % Y2O3 at -195 C. These observations are consistent with a transformation toughening model. The increase in K sub IC with ZrO2 content results from the resultant increase in the number of ZrO2 particles which transform to the monoclinic phase during crack propagation. Microstructural analyses are discussed in reference to microcracking. DOE

**N82-14301#** California Univ., Livermore. Lawrence Livermore Lab.

**MECHANICAL AND THERMOPHYSICAL PROPERTIES OF HOT-PRESSED SYNROC B**

C. L. Hoenig, H. W. Newkirk, R. A. Otto, R. L. Bradley, R. E. Brown, A. R. Ulrich, and R. C. Lum 6 May 1981 20 p refs
(Contract W-7405-eng-48)
(DE81-029299; UCRL-53143) Avail: NTIS HC A02/MF A01

The optimal SYNROC compositions for use with commercial waste are reviewed. Large amounts of powder (about 2.5 kg) were prepared by conventional ceramic operations to test the SYNROC concept on a processing scale. Samples 15.2 cm in diameter, were hot pressed in graphite, and representative samples were cut for microstructural evaluations. Measured mechanical and thermophysical properties did not vary significantly as a function of sample location and were typical of titanate ceramic materials. DOE

**N82-14302#** Technische Univ., Berlin (West Germany). Inst. fuer Nichtmetallische Werkstoffe.

**PREPARATION OF SINTER ACTIVE SILICON CARBIDE POWDERS Final Report, Apr. 1980**

Wolfgang Boecker, Hans Hausner, and Heide Landfermann Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-038; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 23.10

Sinter active alpha SiC powders were prepared by processing of Acheson grade silicon carbide and beta SiC powders through the thermal decomposition of methylsilane. The sintering behavior of the powders when adding boron, aluminum or various compounds of these elements was investigated. The influence of various processing steps on the density and the microstructure of the silicon carbide is discussed. Sinter densities > or = 95% are achieved with both type of powders by sintering at temperatures of 2000 C. Author (ESA)

**N82-14303#** Kunstoffen en Rubber Instituut TNO, Delft (Netherlands).

**EXAMINATION OF A DAMAGED GUN SHIELD OF OTA MELARA**

G. Hamm 11 Jun. 1980 5 p
(Contract A80/KM/064)
(KRI-204/80; TDCK-75033) Avail: NTIS HC A02/MF A01

A glass fiber reinforced polyester gun shield that was damaged

during service was studied. Visual inspection suggested that a large deformation of the dome, caused by large waves, produced high stresses in the laminate, causing local ruptures and collapse. Bending tests, shear tests, and glass content tests show no defect in the material, but stiffening ribs should be strengthened to increase load bearing capacity of the shield when faced with large waves. Author (ESA)

# 25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

**N82-14304** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**POTENTIOMETRIC STRIPPING AS A DETECTOR FOR FLOW INJECTION ANALYSIS OF METAL IONS Ph.D. Thesis**
Tseng-En Hu 1981 232 p
Avail: Univ. Microfilms Order No. 8121500

An automated flow injection analysis, of trace metals for and the use of potentiometric stripping as a detector is demonstrated. The detector provides sensitivity comparable to that of linear scan anodic stripping voltammetry, does not require deaeration and therefore the speed of the analysis is considerably faster than anodic stripping voltammetry. The limited dispersion concept in flow injection analysis was used to achieve peak separation for samples containing both Pb(II) and Sn(IV); Pb(II) and T1(I); and Cu(II) and Bi(II). The otherwise overlapped peaks were separated by performing the stripping in an electrolyte which is optimized for the peak separation. This technique decomposes the overlapped peaks chemically and the results are more reproducible than the conventional matrix exchange method. Dissert. Abstr.

**N82-14305** Defence Research Information Centre, Orpington (England).
**APPLICATION OF RESONANCE RAMAN SPECTROMETRY IN HIGH PERFORMANCE LIQUID CHROMATOGRAPHY**
Shinji Saito, Norio Teramae, and Nobuyuki Tanaka Aug. 1981 13 p refs Transl. into ENGLISH OF 'Nippon Kagaku Kaishi, (Japan) v. 9, 1980 p 1363-1366 Presented at 41st Spring Ann. Conf. of the Japan Chem. Assoc.
(DRIC-T-6367; BR80388) Copyright. Avail: Issuing Activity

A detection system for the sensitive and selective analysis of the eluted components of a high performance liquid chromatograph is described. The system connects a laser Raman spectrophotometer to a high performance LC. Results from investigations of dimethylaminoazobenzene compounds show that the LC Raman effect is highly sensitive and has a high degree of selectivity. It is possible to evaluate independently compounds which can not be separated by other methods. Author (ESA)

**N82-14306#** Technische Hogeschool, Eindhoven (Netherlands).
**INTEGRATED SCHOTTKY LOGIC Ph.D. Thesis**
Jan Lohstroh Nov. 1981 232 p refs
Avail: NTIS HC A11/MF A01

Integrated Schottky logic (ISL) is a bipolar logic concept that uses existing processes. It combines device structures, which are already known separately, with a very attractive type of logic gate which is used for high speed (VLSL), very large scale integration. Aspects of ISL, its performance in different processes, switching speed (calculated and measured), first order modeling, its behavior is a function of temperature, the noise margins as a function of temperature, and its applications are discussed. Bipolar circuits are compared with MOS circuits in general, and bipolar circuit technology combinations which satisfy VLSI requirements are discussed. A general noise margin test method is proposed, which is applicable to every type of logic circuit. S.L.

**N82-14307*#** National Aeronautics and Space Administration, Washington, D. C.
**DEPOSITION OF THIN INSULATION LAYERS FROM THE GAS PHASE**
Reinhard Behn, Horst Hagedorn, Johann Kammermaier, Manfred Kobale, Horst Packonik, Dietrich Ristow, and Gerhard Seebacher Jul. 1981 86 p refs Transl. into ENGLISH from West German Rept. BMFT-FB-T-76-66 Unternehmensber. Bauelemente Hauptber. Grundlagnentwicklung, and Bundesmin. fuer Forsch. und Technol. Munich, May 1976 p 1-88 Original language document was announced as N77-29418 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76607) Avail: NTIS HC A05/MF A01 CSCL 07D

The continuous deposition of thin organic dielectric films on metallized carrier foils by glow discharge in monomeric gases is described. Depending on the applied monomers, the films had a dissipation factor of .001 to .003 (1 kHz), a relative permittivity of 2.3 to 2.5 and a resistivity of about 10 to the 17th power omega cm. Additionally, they proved to have a high mechanical homogeneity. Self-healing rolled capacitors with a very high capacitance per volume and of consistently high quality were fabricated from the metallized carrier foils covered with the dielectric film. J.D.H.

**N82-14308*#** Honeywell Electro-Optics Center, Lexington, Mass.
**DEFECT CHEMISTRY AND CHARACTERIZATION OF (Hg, Cd)Te Interim Report, 1 Jan. - 30 Jun. 1981**
H. R. Vydyanath 30 Jun. 1981 51 p refs
(Contract NAS8-33245)
(NASA-CR-161928) Avail: NTIS HC A04/MF A01 CSCL 07D

Single crystal samples of phosphorus doped Hg sub 0.8 Cd sub 0.2 Te were anneald at temperatures varying from 450 C to 600 C in various Hg atmospheres. The samples were quenched to room temperature from the annealing temperatures. Hall effect and mobility measurements were performed at 77 K on all these samples. The results indicate the crystals to be p type for a total phosphorus concentration of 10 to the 19th power/cu cm in all the samples. The hole concentration at 77 K increases with increasing Hg pressures at 450 C and 500 C contrary to the observation in undoped crystals. Also, at low Hg pressures the concentration of holes in the phosphorus doped crystals is lower than in the undoped crystals. The hole concentration in all the samples is lower than the intrinsic carrier concentration at the annealing temperatures. The hole mobility in the doped crystals is similar to that in the undoped crystals. A defect model according to which phosphorus behaves as a single acceptor interstitially, occupying Te lattice sites while it acts as a single donor occupying Hg lattice sites was established. Equilibrum constants established for the incorporation of all the phosphorus species explain the experimental results N.W.

**N82-14309*#** National Aeronautics and Space Administration, Washington, D. C.
**DETERMINATION OF A KINETIC REGION IN CATALYTIC OXIDATION OF CARBON MONOXIDE**
M. Yu. Sultanov and Kh. A. Sadykhova Nov. 1981 7 p refs Transl. into ENGLISH from Azerb. Khim. Zh. (USSR), no. 2, 1980 p 3-6 Transl. by SCITRAN, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-76651) Avail: NTIS HC A02/MF A01 CSCL 07D

The catalytic activity of cupric oxide activated with ceric oxide in a braod interval of volumetric velocities was investigated. It was determined that for practical catalysts used in the diffuse region, dilution of the active substance by an inert diluent increases the effectiveness of the catalysts. J.D.H.

**N82-14310*#** National Aeronautics and Space Administration, Washington, D. C.
**REACTIVITY OF PYRYLIUM SALTS TOWARD BASIC REACTANTS**
Richard Neidlein and Peter Witerzens Aug. 1981 16 p Transl. into ENGLISH from Archiv der Pharmacie (Weinheim), no. 309, 1976 p 649-660 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76675) Avail: NTIS HC A02/MF A01 CSCL 07D

The reactivity of some N-acyl and N-sulfonyl-hydrazines 2-4, 10a-10g, 12, 13, 16a, 16b and of hydrazones 18, benzyldihydrazone 21 towards pyrylium salts 1 was examined. By reaction of 2,4,6-trimethyl-pyrylium salt 1 with substituted hydrazines some pyridinium salts were obtained. Relationships between basicity and reactivity were discussed. B.W.

**N82-14311#** United Technologies Research Center, East Hartford, Conn.
**INVESTIGATION OF THE CARS SPECTRUM OF WATER VAPOR Final Report, Jul. 1980 - May 1981**
J. A. Shirley and R. J. Hall Wright-Patterson AFB, Ohio AFWAL Aug. 1981 65 p refs
(Contract F33615-80-C-2061; AF Proj. 2301)
(AD-A105235; UTRC/R81-955278-10; AFWAL-TR-81-2075) Avail: NTIS HC A04/MF A01 CSCL 07/4

The coherent anti-Stokes Raman spectrum of water vapor was measured and compared with CARS code calculations to facilitate diagnostics of this important combustion product. Measurements were made with mixtures of H2O and a diluent gas heated to 450-800 K in a test cell at atmospheric pressure. The experimental spectra were computer fit to calculations to deduce H2O Raman linewidths. The self broadening coefficient was found to be 0.5 per cm/atm at 773K and to depend inversely on the temperature. N2 and CO2 broadening coefficients are comparable, essentially independent of temperature at 0.17 per cm/atm over this range. Measurements were also made in the post-reaction region of stoichiometric CH4-air flames at 1670 and 2070 K. The linewidth was inferred to be 0.24-0.25 per cm/atm in both flames. Author (GRA)

**N82-14312#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Fuels Branch.
**DETERMINATION OF SELECTED DISTILLATE BLENDING SOLVENTS IN SIMPLE AND COMPLEX AIRCRAFT FUEL MATRICES VIA GLASS CAPILLARY GAS CHROMATOGRAPHY Final Report, Jan. - Dec. 1979**
Paul C. Hayes, Jr. Jun. 1981 44 p refs
(AF Proj. 3048)
(AD-A105588; AFWAL-TR-80-2082) Avail: NTIS HC A03/MF A01 CSCL 07/4

A study was initiated to accurately determine the volume percent of various hydrocarbon distillate solvents present in blends with aircraft jet fuels JP-4 and JP-8. These modified fuels were an integral part of a combustion program to elucidate the effect altered fuel properties had on selected combustion parameters. A method of analysis was desired to check the accuracy of both in-house and contractual blending work. The effort was further expanded to even determine the amount of JP-4 present in the event of gross cross-contamination. Author (GRA)

**N82-14313#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Fuels Branch.
**DETERMINATION OF PYRIDINE IN MODIFIED JP-4 VIA HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC) Final Report, Jun. - Jul. 1975**
Paul C. Hayes, Jr. Apr. 1981 24 p refs
(AF Proj. 3048)
(AD-A105589; AFWAL-TR-80-2081) Avail: NTIS HC A02/MF A01 CSCL 07/4

A study was initiated to accurately determine the weight percent of pyridine present in pyridine-modified JP-4 used for contractual combustion studies. High Performance Liquid Chromatography (HPLC) was the method of choice. A chromatographic process was developed and systematic quantitative analses performed to substantiate the accuracy and precision of the new test method. A computing integrator interfaced with the HPLC system performed all data collection and calculations automatically, with the results printed on a teletype. Least square curve fitting accentuated the reliability for determining pyridine in the 0.5 to 5.0 weight percent concentration range. Author (GRA)

**N82-14314#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Electronic Research Group.
**CATHODOLUMINESCENCE CHARACTERIZATION OF ION IMPLANTED GaAs Final Report, Apr. 1977 - Jul. 1978**
Milton L. Cone Apr. 1981 121 p refs
(AF Proj. 2306)
(AD-A105656; AFWAL-TR-80-1184) Avail: NTIS HC A06/MF A01 CSCL 07/4

Depth-resolved cathodoluminescence was used to study ion implanted GaAs. This was done in a two step process. First a model for the luminescence from ion implanted GaAs was developed. This model includes a detailed Monte Carlo simulation of electrons penetrating into GaAs. The result of this calculation is a prediction of luminescent intensity as a function of electron beam energy. This calculation differs from preceding ones in that the ion implanted profile is specifically included in the analysis. Second, the model was validated by a suitable experiment that confirms the theoretical predictions. The luminescence measurements were made on Mg ions implanted into epitaxial GaAs. Mg was chosen since it has not been previously studied in epitaxial GaAs. The results of this research include the identification of many of the lines in the Mg implanted GaAs spectrum from 1.32 ev to 1.52 ev, a study of the effect of changing the current of the electron beam on the spectra and a comparison of the theoretical and experimental luminescence curves. These results show that changing the current density at the sample surface dramatically changes the spectra and that good agreement exists between the theoretical and experimental luminescence curves. Author (GRA)

**N82-14315#** George Washington Univ., Washington, D.C. Dept. of Chemistry.
**INTERPRETATION OF THE NITROGEN KVV AUGER LINESHAPE FROM ALKALI METAL NITRATES**
F. L. Hutson, D. E. Ramaker, B. I. Dunlap, J. D. Ganjei, and J. S. Murday Oct. 1981 21 p Submitted for publication
(Contract N00014-80-K-0852)
(AD-A105877; TR-6) Avail: NTIS HC A02/MF A01 CSCL 07/4

Experimental N KVV Auger lineshapes from sodium nitrate, produced by both X-ray (XEA) and electron (EEA) excitation, are compared to theoretically derived lineshapes based on populations derived from a GTO-LCAO-X alpha model. The one-electron orbital energies and valence line widths are determined from X-ray emission and photoelectron data; the Auger matrix elements are determined from experimental gas phase atomic Auger data. The theoretical Auger energies include hole-hole repulsion and relaxation. Theoretical lineshapes using the local and the Mulliken x alpha populations are generated, and a set of empirical populations are also determined. This work emphasizes the importance of shake-off arising from creation of the initial core hole and its effect on the Auger lineshape. A theoretical shake/Auger satellites lineshape is generated and found to contribute up to 35% of the total intensity. The XEA and EEA lineshapes (after correction for the sample and spectrometer transmission response) each show five features, but some differences are noted. These are attributed primarily to beam damage and charging effects on the EEA lineshape. The theoretical lineshapes reproduces the five principal features of the experimental spectra; specific features in the lineshape are shown to reflect the relative size of the Auger matrix elements, the symmetry of the NO3 ion, and satellite contributions. Arguments for the validity of a one-electron orbital model to describe the Auger lineshape are presented. Author (GRA)

**N82-14316#** Naval Postgraduate School, Monterey, Calif.
**COMBUSTION BEHAVIOR OF SOLID FUEL RAMJETS. VOLUME 1: CORRELATION OF REACTING AND NON-REACTING FLOW CHARACTERISTICS Final Report**
Brian A. Binn, Winston E. Scott, and David W. Wetzer Jul. 1981 68 p refs
(AD-A106061; NPS67-81-010-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21/2

An experimental investigation was conducted to determine the relationship between the cold flow characteristics of velocity, pressure distribution, and turbulence intensity and the reacting flow performance and combustion characteristics of a solid fuel ramjet. The effects of configuration and air flow changes on the above characteristics were examined. Average regression rates and combustion efficiencies were not significantly affected by changes in configuration. These variations in test conditions significantly affected the centerline turbulence intensity but not the near-wall turbulence intensity in cold flow. Near-wall

turbulence profiles in cold flow were found to correlate with the fuel regression profiles in reacting flows. The use of bypass resulted in decreases in regression rate and efficiencies for all cases. Author (GRA)

**N82-14317#** Delaware Univ., Newark. Center for Catalytic Science and Technology.
**DEVELOPMENT OF SUPERIOR DENITROGENATION AND ISOMERIZATION CATALYSTS FOR PROCESSING CRUDE OIL DERIVED FROM SHALE, PART 1 Final Interim Report**
James R. Katzer, Alvin B. Stiles, and Harold Kwart 15 Aug. 1981 23 p refs
(Contract N00019-80-K-0507)
(AD-A105667) Avail: NTIS HC A02/MF A01 CSCL 08/7

For purposes of immediate application to shale oil, the most important conclusions derived from this preliminary work are the following: (1) As with quinoline, total nitrogen removal in multiring condensed heterocycled amines involves hydrogenation of the aromatic rings followed by (an often slower) process of C-N bond scission. (2) With multiring substrates of this nature the ring hydrogenation occurs more rapidly than the C-N bond scission reactions leading to the accumulation of considerable concentrations of hydrogenated nitrogen-containing species in the reaction mixture. (3) The overall rates of N-removal do not vary significantly because the rates of C-N bond scission in these hydrogenated species are quite similar. (4) The rates of these reactions would appear to be somewhat affected by steric hindrance to adsorption caused by the puckered cyclohexane rings and the similarity of rates must be due to the similarity of the steric effects. GRA

**N82-14318#** Texas A&M Univ., College Station. Dept. of Chemistry.
**HIGH PERFORMANCE LIQUID CHROMATOGRAPHY/ VIDEO FLUOROMETRY. PART 3: APPLICATIONS Interim Technical Report**
Dennis C. Shelly, Michael P. Fogarty, and Isiah M. Warner 30 Sep. 1981 41 p refs Sponsored in part by the Upjohn Co. Submitted for publication
(Contracts N00014-80-C-0703; DE-AS05-80EV-10404; NR Proj. 051-747)
(AD-A105945; TR-3) Avail: NTIS HC A03/MF A01 CSCL 07/4

A video fluorometer is used as a detector for HPLC to characterize highly complex samples. Data selection and evaluation techniques are discussed so as to speed the spectral identification process. Several well-known polynuclear aromatic hydrocarbons are found in the samples. Author (GRA)

**N82-14319#** Illinois Univ. at Urbana. Dept. of Aeronautical and Astronautical Engineering.
**A STUDY OF THE MECHANISM OF LEAN LIMIT FLAMMABILITY Final Report, 21 May 1978 - 21 Aug. 1981**
Roger A. Strehlow 31 Aug. 1981 10 p
(Contract DAAG29-80-C-0118; Grant DAAG29-78-G-0098)
(AD-A105952; ARO-15662.1-E) Avail: NTIS HC A02/MF A01 CSCL 21/2

In this study the mechanism of extinction of a lean limit flame in a premixed methane-air or propane-air system was studied in a vertical rectangular flammability tube with variable inside dimensions. Both upward and downward extinction were observed for methane while only upward extinction was studied for propane. In addition to the observations of extinction, a theoretical analysis of the flow ahead of the upward propagating flame was made which showed that at extinction the upward propagating flame is severely stretched in the Karlovitz sense. The upward propagating flame in the 50 x 50 mm tube had a stable hemispherical shape with a trailing skirt towards the walls. Extinction in this case occurred from the central holding region of the flame where the stretch was calculated to be the maximum. In larger than 50 x 50 mm tubes the flame is hydrodynamically unstable and extinction occurs on one of the instability cycles. The downward propagating flame in methane is almost flat in the tube but it propagates in an unstable manner. It was observed, both with image intensifier photographs and with a schlieren optics, that this flame extinguished by first losing heat to the walls. Thus the downward propagating flame is extinguished by heat loss mechanism coupled with a differential buoyancy driving mechanism which is sufficiently complex that it cannot be modeled using one dimensional heat loss theories. GRA

**N82-14320#** Oak Ridge National Lab., Tenn. Chemical Technology Div.
**DESTRUCTION OF OXALATE BY REACTION WITH HYDROGEN PEROXIDE**
J. C. Mailen, O. K. Tallent, and P. C. Arwood Sep. 1981 30 p refs
(Contract W-7405-eng-26)
(DE81-030624; ORNL/TM-7474) Avail: NTIS HC A03/MF A01

The destruction of oxalate by oxidation to carbon dioxide using hydrogen peroxide was studied as an alternative method for the disposal of oxalate in connection with the possible use of an aqueous hydrazine oxalate solution as a scrubbing agent for solvent cleanup in processes for the recovery of uranium, plutonium, and thorium by solvent extraction. The rate of oxidation of oxalate by hydrogen peroxide in acid solution at the flux temperature was adequate for process application; reaction half-times at 1000 C were less than on hour when the hydrogen peroxide concentration was greater than 0.5 M. The reaction was first order with respect to both the oxalate and hydrogen peroxide concentrations and had an activation energy of 58.7 kJ/g-mol. In the near-neutral hydrazine oxalate solutions, the reaction of either component with hydrogen peroxide was to slow for process application. DOE

**N82-14321#** State Univ. of New York, Albany.
**FUNDAMENTAL STUDIES IN ISOTOPE CHEMISTRY Progress Report, 1 Oct. 1980 - 1 Aug. 1981**
Jacob Bigeleisen (State Univ. of New York at Stony Brook) 1981 25 p refs
(Contract DE-AC02-79ER-10346)
(DE82-000651; DOE/ER-10346/T1) Avail: NTIS HC A02/MF A01

The current program, as in the past, utilizes theoretical advances made specifically with respect to isotope chemistry in the study of the structure of matter. Experimental investigation using isotope effects provides a unique tool for the determination of the mean square force on an atom in a molecular and how it is affected by intermolecular forces. We have completed the systematic study of the isotope chemistry of hydrogen. Studies have been made of the isotopic reduced partition function ratio, (s/s')f, of thirtynine diatomic and nineteen polyatomic hydrides. It encompasses compounds of hydrogen with every element in each row and each column of the periodic table. This progress report also includes a description of our final design for sampling of cryogenic liquid. Such a sampler is necessary if we are to realize the full potential of the isotopic fraction method to study the mean square forces and torques in polyatomic liquids. DOE

**N82-14322#** Los Alamos Scientific Lab., N. Mex.
**CHEMICAL ELEMENT CONCENTRATIONS IN LIQUIDS AND SOLIDS ASSOCIATED WITH POWER PLANTS USING FGD SYSTEMS**
Lawrence Edward Wangen and Marianne Mills Jones Aug. 1981 27 p refs
(Contract W-7405-eng-36)
(DE81-030422; LA-8929-MS) Avail: NTIS HC A03/MF A01

Solid and liquid process steam samples from eight power plants using wet flue gas desulfurizaton (FGD) scrubbers were analyzed for the trace elements As, B, Br, Cl, Cd, Co, Cr, F, Ga, I, Mo, Ni, Pb, S, Sb, Se, Th, U, V, W, and Zn as well as several major and minor elements. Four plants burned high-sulfur coals and three burned low-sulfur coals. One plant used a low-sulfur lignite coal. Four FGD systems used limestone, two used lime, and two used alkaline flyash as scrubbing reagent. Elemental concentration data were used to identify chemical elements of concern regarding their potential for causing environmental harm as a result of the disposal of residues associated with FGD systems. Calcium, Mg, Mn, Ni, Se, and SO4(2-) were identified as most generally problematic. The elements B, Cd, F, and Mo were judged as potentially problematic in certain situations. Generally FGD liquors from power plants that burned low-sulfur western coals had highest concentrations of most trace elements. DOE

**N82-14323#** Sandia Labs., Albuquerque, N. Mex.
**CATALYTIC EFFECT OF IRON IN HYDROGASIFICATION OF COAL**
T. D. Padrick, D. D. Dees, and T. M. Massis 1981 9 p refs Presented at the 11th North Am. Thermal Analysis Soc. Conf., New Orleans, 19 Oct. 1981
(Contract DE-AC04-76DP-00789)
(DE81-023928; SAND-81-0715C; CONF-811014-2) Avail: NTIS HC A02/MF A01

Results indicate that finely divided hematite enhances the production of methane, by a factor of fifteen, during char gasification at one atmosphere of hydrogen. Gasification rates were measured by heating the samples in a thermal gravimetric analysis system to a fixed temperature and then monitoring the rate of weight loss versus time. Product gas analysis indicates that during char gasification with hematite present, greater than 85 mole % of the gas is methane. The catalytic form of the hematite was identified as reduced iron. The effect of the reduced iron as a catalyst is strongly dependent on particle size. The catalytic activity is also dependent on precursor species with the following order observed: Fe2O3, Fe3O4, FeS2, Fe. DOE

**N82-14324#** Rockwell International Corp., Golden, Colo.
**DIRECT ANALYSIS OF PLUTONIUM METAL FOR GALLIUM, IRON AND NICKEL BY ENERGY DISPERSIVE X-RAY SPECTROMETRY**
H. L. Bramlet and J. H. Doyle 1981 10 p ref Presented at the X-ray Analysis Conf., Denver, 3 Aug. 1981
(Contract DE-AC04-76DP-03533)
(DE81-028046; RFP-3214; CONF-810854-1) Avail: NTIS HC A02/MF A01

An X-ray secondary target method for routine determination of gallium, iron, and nickel in plutonium metal is described that has significant advantages over wet chemical analysis. Coupons requiring minimal preparation for analysis are produced as a breakaway tab on the plutonium ingot. All three elements are determined on the same coupon. Gallium is determined using an arsenic secondary target followed by iron and nickel using a zinc target. The analysis times are 5 minutes for gallium and 15 minutes for the combined iron and nickel. The method of analysis was evaluated in the range of from 0.5 to 1.5% gallium. Iron was investigated over the range of 67 to 3000 ppM and nickel from 64 to 110 ppM. DOE

**N82-14325#** California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
**OXYGEN REDUCTION WITH CARBON SUPPORTED METALLIC CLUSTER CATALYSTS IN ALKALINE ELECTROLYTE**
P. N. Ross, Jr. Mar. 1981 16 p refs Presented at Symp. on Electrocatalyis, Minneapolis, 10-15 May, 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE81-027400; LBL-11891; CONF-8105105-6) Avail: NTIS HC A02/MF A01

The atomic structure of clusters of Pt group metals dispersed on carbon blacks was examined using transmission electron microscopy and extended X-ray absorption fine structure spectroscopy. Both the catalyzation procedure and the microstructure of the carbon influence the resulting structure of the metal cluster. Colloidal catalyzation of Pt onto a turbostratic carbon black support yields a metals cluster with an amorphous structure, i.e., no atomic order. The amorphous structure is metastable, undergoing an ordering transition at temperature above ca. 800 C. The amorphous form of Pt interacts with both oxygen and water more strongly tha the crystalline form This stronger interaction produces characteristically different kinetic behavior of the catalysts for oxygen reduction. These differences take the form of a compensation effects, with lower activation energy and lower pre-exponential factor for the amorphous clusters. The properties of highly dispersed Pt clusters relative to the bulk form appears to be a general feature of the Group VIII metals. DOE

**N82-14326#** Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
**INVESTIGATION OF LUMINESCENCE IN THE CHARGE EXCHANGE PROCESS OF Ar++ WITH N2 OF N(+) WITH CO [UNTERSUCHUNG DER LUMINESZENZ BEIM LADUNGSAUSTAUSCH VON Ar++ MIT N2 UND N+ MIT CO]**
Dieter Neuschaefer Mar. 1980 80 p refs In GERMAN
(MPIS-3/1980; ISSN-0436-1199) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15

Luminescence spectra of two ion-molecular reactions were analyzed using computerized simulation. Vibration and rotation states of the luminescent reaction products were studied in terms of impact dynamics. The charge exchange of Ar++ ions with molecular nitrogen and the reaction of N+ ions with CO (in an energy domain from 3 to 1000 eV) were investigated in their electronically excited states. The rotational spectra depend on the vibration level and show increased rotation excitation at lower energy. Author (ESA)

**N82-14327#** Prins Maurits Lab. TNO, Rijswijk (Netherlands). Inst. voor Chemische en Technologische Research.
**A MICROWAVE INDUCED HELIUM PLASMA EMISSION DETECTOR FOR GAS CHROMATOGRAPHY**
A. Verweij Dec. 1979 26 p refs
(Contract A74/K/029)
(PML-1979-75; TDCK-73058) Avail: NTIS HC A03/MF A01

The suitability of the detector for analysis of carbon, fluorine, chlorine, phosphorus and sulfur compounds is investigated. The influence of variations in the microwave power, the helium gas flow, the discharge gas pressure and the observation zone of the plasma on the operation of the detector were studied. From an experiment carried out with two model compounds, the detection limit and linear dynamic range of the detector are determined. Author (ESA)

**N82-14328** Oklahoma State Univ., Stillwater.
**STUDIES IN UNSEGMENTED CONTINUOUS-FLOW ANALYSIS. PART 1: REPETITIVE DETERMINATIONS OF Cu(2) CATALYST. PART 2: REPETITIVE DETERMINATIONS OF BROMINE AND CHLORINE IN GASEOUS SAMPLES AT A GAS-SOLID INTERFACE Ph.D. Thesis**
Savakkattupalayam Muniappan Ramasamy 1981 155 p
Avail: Univ. Microfilms Order No. 8123853

A catalytic method for trace analysis in a continuous, unsegmented, closed flow system which is selective, and sensitive has a high sample throughput and minimizes waste handling is described and evaluated. The sample and the thiosulfate reactant were injected into the circulating ferric thiocyanate solution and the decrease in absorbance was monitored. Controlled potential electrolysis was employed for the removal of the catalyst after its assay. A method of repetitive determinations of bromine in gaseous samples, based on monitoring the transient signal resulting from two consective reactions taking place at gas-solid interface is described and evaluated. The sample was intercalated into a continous flow of carrier (air) gas which impinged on a layer of a dried reagent mixture of alpha--naphthaflavon, NF, and As(III), on the surface of a filter paper. The course of the reactions was followed by monitoring the formation and disappearance of the red-colored Br/NF with direct transmission photometry. Repetitive determinations of chlorine were made possible by incorporating Br(-) ions into the filter paper. Dissert. Abstr.

**N82-14329** Seton Hall Univ., South Orange, N. J.
**THE ELECTRONIC STRUCTURE OF PORPHYRINS AND METALLOPORPHYRINS Ph.D. Thesis**
Virginia Ellen Bass 1981 169 p
Avail: Univ. Microfilms Order No. 8122396

Current molecular orbital descriptions of the macrocycles are reviewed and analyzed in terms of their ability to account for the intensities and polarizations of the absorbance and emission vectors. A modified Huckel MO calculation was performed on the tetraphenyl and octaethylporphyrins and their derivatives. The resulting ground state energy level diagrams were used to estimate the energies of the excited state configurations. Dissert. Abstr.

# 26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

**N82-14330** Stanford Univ., Calif.
**MULTIAXIAL FATIGUE OF METALS Ph.D. Thesis**
Yogendra Somnath Garud 1981 178 p
Avail: Univ. Microfilms Order No. 8124070

Fatigue of metals under loadings which induce non-zero principal stresses along more than one direction in a part is considered. A literature survey focusing on a critique and comparison of existing criteria for evaluation of multiaxial fatigue is presented. A method for assessing multiaxial fatigue is proposed. In this approach fatigue life (to crack initiation) is related to the plastic work (density) per cycle of loading. The relation can be determined from results of fatigue tests on smooth specimens subjected to uniaxial loading. Fatigue life predictions using this approach are found to agree, within a factor of three on life, with tests under in-phase as well as out-of-phase combined axial and torsional loading for 1% Cr-Mo-V steel and 7075-T6 aluminum. A set of constitutive relations is developed to predict stress-strain response under general loading. Dissert. Abstr.

**N82-14331** Defence Research Information Centre, Orpington (England).
**QUANTITATIVE DETERMINATION OF FLUORINE IN STEEL-MAKING SLAGS BY THE ION SELECTIVE ELECTRODE**
Teruaki Ishii and Mutsumi Ihida Aug. 1981 13 p refs Transl. into ENGLISH of 'Bunseki Kagaku' (Japan), v. 22, 1973 p 665-669
(DRIC-T-6448; BR80028) Copyright. Avail: Issuing Activity

A circuit with a high input impedance was devised which gives good results. Using this apparatus, the effects of pH and of interfering ions were determined. The values obtained in the quantitative determination of fluorine by this method are in good agreement with those obtained by the zirconium alizarine absorption photometric method. Author (ESA)

**N82-14332*#** National Aeronautics and Space Administration, Washington, D. C.
**EFFECT OF THE POWDER CHARACTERISTICS OF SiSUB3NSUB4 ON THE MICROSTRUCTURE OF SINTERED BODIES**
G. Woetting and H. Hausner Nov. 1981 15 p refs Transl. into ENGLISH from Keramische Z. (West Germany), v. 32, no. 10, 1980 p 579-581 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Technische Univ., Berlin
(Contract NASw-3198)
(NASA-TM-76619) Avail: NTIS HC A02/MF A01 CSCL 11F

Silicon nitride powders sintered with the addition of 2 wt% MgO to 95% theoretical density after attrition milling and subsequent purification were evaluated. Preparation of the powders is described. The powder characteristics (specific surfaces, iron concentration, and oxygen content), and density, weight loss, and phase state of the sinter bodies as a function of powder preparation are presented. J.D.H.

**N82-14333*#** Avco Lycoming Div., Stratford, Conn. Materials Lab.
**DEVELOPMENT OF IMPROVED HIGH TEMPERATURE COATINGS FOR IN-792 + Hf Final Report**
D. D. Profant and S. K. Naik Jun. 1981 95 p refs
(Contract NAS3-22371; DA Proj. 1L1-62209-AH-76)
(NASA-CR-165395) Avail: NTIS HC A05/MF A01 CSCL 11F

The development for t-55 l712 engine of high temperature for integral turbine nozzles with improved thermal fatigue resistance without sacrificing oxidation/corrosion protection is discussed. The program evaluated to coating systems which comprised one baseline plasma spray coating (12% Al-NiCoCrALY), three aluminide coatings including the baseline aluminide (701), two CoNiCrAly (6% Al) + aluminide systems and four NiCoCrY + aluminide coating were evaluated. The two-step coating processes were investigated since it offered the advantage of tailoring the composition as well as properly coating surfaces of an integral or segmented nozzle. Cyclic burner rig thermal fatigue and oxidation/corrosion tests were used to evaluate the candidate coating systems. The plasma sprayed 12% Al-NiCoCrAlY was rated the best coating in thermal fatigue resistance and outperformed all coatings by a factor between 1.4 to 2.5 in cycles to crack initiation. However, this coatings is not applicable to integral or segmented nozzles due to the line of sight limitation of the plasma spray process. The 6% Al-CoNiCrAlY + Mod. 701 aluminide (32 w/o Al) was rated the best coating in oxidation/corrosion resistance and was rated the second best in thermal fatigue resistance. J.D.H.

**N82-14334#** Southwest Research Inst., San Antonio, Tex.
**CRACK TIP PLASTICITY ASSOCIATED WITH CORROSION ASSISTED FATIGUE Interim Report, Jun. 1980 - Jun. 1981**
D. L. Davidson and J. Lankford 18 Sep. 1981 50 p refs
(Contract N00014-75-C-1038; NR Proj. 036-109)
(AD-A105529) Avail: NTIS HC A03/MF A01 CSCL 11/6

Preliminary data is presented on the effect of a water vapor environment on the deformation within the plastic zone of fatigue cracks in 7075-T6. Results in the water vapor environment is compared to those in a vacuum environment. High spatial resolution observations have been made using a special cyclic stage for the SEM and strains have been determined using the stereoimaging technique. Crack tip opening is shown to be a power function of the distance behind the crack tip, in agreement with a theoretical derivation of this correlation. The crack tip strain correlates with the crack opening at 1 micrometer behind the crack tip. Crack tip strains are shown to vary considerably for a fixed cyclic stress intensity. By ignoring some data, a preliminary analysis is made which indicates that the water vapor environment lowers crack tip strains. Strain distribution within the plastic zone is shown to fit a logarithmic function, as opposed to a power function, although there is still some uncertainty in this result. Work on 7075-T6 and the powder metallurgy alloy MA-87 is continuing, with definitive results expected next year. Author (GRA)

**N82-14335#** Naval Postgraduate School, Monterey, Calif.
**MECHANISMS OF ELEVATED TEMPERATURE FATIGUE DAMAGE IN 2 1/4 Cr - 1 Mo STEEL M.S. Thesis**
Pierre G. Vining Jun. 1981 138 p refs
(AD-A105786) Avail: NTIS HC A07/MF A01 CSCL 11/6

The microstructural changes and fatigue crack growth rates induced by elevated temperature push-pull fatigue and creep fatigue tests in 2 1/4 Cr - 1 Mo steel have been examined using optical and electron microscopy techniques. The only microstructural change noted was the development of dislocation substructures in the proeutectoid ferrite. Creep fatigue tests with a single maximum strain hold period per cycle created a cellular substructure whose size was solely dependent on the carbide interparticle spacing. Temperature and strain range effects were noted on the dislocation densities in the maxtrix which were generally consistent with work reported in the literature. As there were no resolvable changes in the carbides in the ferrite, it was concluded that there must be some change in the microstructure on a finer scale, such as the early stages of MO-C-Mo cluster formation, which might explain the cyclic hardening/cyclic softening response of the alloy. The fatigue crack growth rate of the alloy was strongly dominated by the hold periods imposed during the loading cycle. A single 0.1 hr. hold period doubled the fatigue crack growth rate obtained for a continuously cycled test and two hold periods per loading cycle gave a four fold increase over the continuously cycled crack growth rate. GRA

**N82-14336#** Brown Univ., Providence, R. I.
**PLASTIC DEFORMATION AND FRACTURE OF STEEL UNDER DYNAMIC LOADING Final Report, 20 Jul. 1980 - 19 Jul. 1981**
J. Duffy Sep. 1981 4 p
(Contract DAAG29-80-K-0045)
(AD-A105997; ARO-17221.2-E) Avail: NTIS HC A02/MF A01 CSCL 11/6

The author summarizes his research effort during the grant period. Included is the development of an infrared radiation

temperature detection system for monitoring the temperature rise in thin-walled steel specimens loaded dynamically in a torsional Kolsky bar. Also included is a description of an investigation aimed at transforming AISI 1020 HRS under controlled conditions of prior austenite grain size, ferrite and pearlite grain sizes to reduce the size and number of carbide plates along the grain boundaries. The transformed material is to be used in a subsequent investigation into the influence of microstructure on the fracture toughness of 1020 HRS.
Author (GRA)

**N82-14337#** Mound Lab., Miamisburg, Ohio.
**MICROSTRUCTURAL ANALYSIS OF KOVAR/MOLYBDENUM AND COPPER/MOLYBDENUM INTERDIFFUSION**
Michael D. Kelly, Kenneth L. Breakall, Jr., and Dale L. Roesch 1981 13 p Presented at the 14th Ann. Technol. Meeting of Intern. Metallographic Soc., San Francisco, 21 Jul. 1981
(Contract DE-AC04-76DP-00053)
(DE81-025919; MLM-2848(OP); CONF-810731-1) Avail: NTIS HC A02/MF A01

Studies were conducted to measure interdiffusion of Kovar/molybdenum and copper/molybdenum at different temperatures for various periods of times. Optimum operating parameters to achieve good bonding while maintaining practical processing time were determined. Metallographic techniques were developed to prepare specimens for microprobe analysis, and to etch specimens for photomicrography. The metallographic techniques used, along with the resulting microprobe analyses, are discussed. DOE

**N82-14338#** Battelle Columbus Labs., Ohio.
**INFLUENCE OF CYCLIC LOAD AND ENVIRONMENTAL EFFECTS ON STRESS CORROSION CRACKING OF SENSITIZED STEEL Final Report**
E. L. White and W. E. Berry Aug. 1981 62 p refs Sponsored in part by EPRI
(EPRI Proj. 311-3)
(DE81-904216; EPRI-NP-1991) Avail: NTIS HC A04/MF A01

An experimental stress corrosion cracking (SCC) study was conducted in order to mitigate SCC in stainless steel piping was boiling water reactor. Temperature effects, dissolved oxygen, and cyclic loading were studied on furnace sensitized Type 304 stainless steel. Slow strain rate tests at 4 million s(+) strain rate produce intergranular stress corrosion cracking (IGSCC) at temperatures above 2040 C, suggesting a threshold temperature for IGSCC of about 1300 C at the 0.2 ppm oxygen level. Saturated solutions of AgCl produce IGSCC in slow strain rate tests in both aerated (8 ppm 02) and deaerated < 0.006 ppM 02) tests at temperature as low as 850 C. A potential hazard in using Ag/AgCl reference electrodes is suggested. Trapezoidal cyclic loading (5 min load/unload, 10 or 75 min at load produces IGSCC. Tests in 8 ppM oxygen water with the 75 min hold cycle, minimum load of 0.1 yield strength and maximum load greater than YS, indicate a threshold temperature for IGSCC of 1900 C. DOE

**N82-14339#** Hanford Engineering Development Lab., Richland, Wash.
**ALLOY DEVELOPMENT FOR CLADDING AND DUCT APPLICATIONS**
J. L. Straalsund and G. D. Johnson 2 Feb. 1981 43 p Presented at the Am. Nucl. Soc. Ann. Meeting, Miami Beach, Fla., 7-12 Jun. 1981
(Contracts DE-AC14-76FF-02170; EY-76-C-14-2170)
(DE81-027843; HEDL-SA-2344; CONF-810606-89) Avail: NTIS HC A03/MF A01

Three general classes of materials under development for cladding and ducts are listed. Solid solution strengthened, or austenitic, alloys are Type 316 stainless steel and D9. Precipitation hardened (also austenitic) alloys consist of D21, D66 and D68. These alloys are similar to such commercial alloys as M-813, Inconel 706, Inconel 718 and Nimonic PE-16. The third general class of alloys is composed of ferritic alloys, with current emphasis being placed on HT-9, a tempered martensitic alloy, and D67, a delta-ferritic steel. The current reference, or first generation alloy, is 20% cold worked Type 316 stainless steel. Second generation alloys for near-term applications include D9 and HT-9. Third generation materials consist of the precipitation strengthened steels and ferritic alloys, and are being considered for implementation at a later time than the first and second generation alloys. The status of development of these alloys is summarized. DOE

**N82-14340#** Battelle Memorial Inst., Richland, Wash.
**EVALUATION OF STRESS-CORROSION CRACKING OF SENSITIZED 304SS IN LOW-TEMPERATURE BORATED WATER**
R. H. Jones, A. B. Johnson, Jr., and S. M. Bruemmer May 1981 15 p refs Presented at the Intern. Conf. on Environ. Degradation of Engr. Mater., Blacksburg, Va., 21 Sep. 1981
(Contract DE-AC06-76RL-01830)
(DE81-028090; PNL-SA-9387; CONF-810913-7) Avail: NTIS HC A02/MF A01

Intergranular stress corrosion cracking was observed in constant extension rate tests, CERT and constant load tests of 304SS tested at 32 C in borated water plus 15 ppm Cl(-). Evidence of IGSCC was obtained in CERT tests of welded pipe samples only when the original inner diameter surface was intact and with 15 ppm Cl(-) added to the borated water while IGSCC occurred in a furnace sensitized pipe sample after 500 h at a constant stress of 340 MPa in borated water containing 15 ppm Cl(-). These results indicate that surface features associated with weld preparation grinding contributed to the susceptability of sensitized 304SS to IGSCC in low temperature borated water; however, the constant load test indicates that such surface defects are not necessary for IGSCC in low tempeature borated water. DOE

**N82-14341#** Oak Ridge National Lab., Tenn.
**MICROSTRUCTURE OF TRIPLE-BEAM ION IRRADIATED Fe AND Fe-Cr ALLOYS**
L. L. Horton, J. Bentley, and W. A. Jesser 1981 5 p refs Presented at the Fusion Reactor Materials Meeting, Seattle, 9 Aug. 1981 Prepared in cooperation with Virginia Univ., Charlottesville
(Contract W-7405-eng-26)
(DE81-028347; CONF-810831-32) Avail: NTIS HC A02/MF A01

The development of defect structures in Fe-10% Cr, triple-beam ion irradiated to 10 dpa at temperatures from 725 to 950 K was studied. Limited cavity formation was observed. Peak swelling of 0.02% occurred at irradiation temperatures of 850 K. Similar irradiations at this temperature led to 0.022% swelling in iron. While no cavities were observed in Fe-5% Cr, calculations have shown that cavities formed at 875 K and above are more bubble-like than those at lower temperatures. Dislocation structures varied from interstitial dislocation loops with b = a < 100 > at low temperature to a coarse dislocation network at 850 K. Large dislocation loops had a convoluted shape which suggested that loop growth had occured preferentially in < 110 < directions. The results are discussed and related to current swelling suppression mechanisms for ferritic steels. DOE

**N82-14342#** Oak Ridge National Lab., Tenn. Metals and Ceramic Div.
**INFLUENCE OF NEUTRON IRRADIATION AT 55 DEG C ON THE PROPERTIES OF AUSTENITIC STAINLESS STEELS**
F. W. Wiffen and P. J. Maziasz 1981 6 p refs Presented at the Fusion Reactor Materials Meeting, Seattle, 9 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028065; CONF-810831-31) Avail: NTIS HC A02/MF A01

Types 316 and 316 + 0.23 wt % Ti stainless steels and 16-8-2 weldment were irradiated in HFIR at 55 C to fluences up to 1.35 times 10 to the 26th power neutrons sq m of (< 0.1 MeV), which produced up to 10.5 dpa and 520 at ppm He. Examination showed no swelling, no cavities, no precipates, but a high concentration of dislocations. Tensile tests showed large increases in the 35 C strength properties, with the weldments the weakest of the materials. The ductility of all materials was reduced by the irradiation, the uniform elongation to only 0.4% in the cold worked material. Tests at temperatures above the irradiation temperature showed an approach to unirradiated properties as the temperature was increased from 200 to 600 C.

Helium embrittlement at 700 C severely reduced elongation. DOE

**N82-14343#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

**EFFECTS OF PULSED DUAL-ION IRRADIATION OF MICROSTRUCTURAL DEVELOPMENT**

N. H. Packan 1981 5 p refs Presented at the Fusion Reactor Materials Meeting, Seattle, 9 Aug. 1981

(Contract W-7405-eng-26)

(DE81-028631; CONF-810831-30) Avail: NTIS HC A02/MF A01

The effect of pulsed irradiation on the development of microstructure during Ni ion bombardment was investigated in a simple austenitic alloy similar to type 316 stainless steel. Bombardment conditions were 10 dpa, 940 K, pulsing with equal on/off times of either 0.5 or 60 s, and the addition of 20 app He/dpa to some specimens either by room temperature peimplantation or by dual-beam coimplantation. Particular care was taken to minimize thermal pulses from beam heating (to < 2 C). The results show that pulsing has a subtle influence, and the effects on specific cavity parameters are complex. Pulsing produced a small increase in swelling in the helium-free case, but a slight decrease for helium-implanted specimens, and it seems to have counteracted the usual stimulative effects of helium on cavity nucleation. DOE

**N82-14344#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

**MECHANICAL RELAXATION RESPONSE OF 2 1/4 Cr-1 Mo STEEL**

R. W. Swindeman 1981 30 p refs Presented at the 28th Sagamore Army Materials Conf., Lake Placid, N.Y., 13 Jul. 1981

(Contract W-7405-eng-26)

(DE81-027301; CONF-810741-1) Avail: NTIS HC A03/MF A01

The mechanical relaxation of 2 1/4 Cr-1 Mo steel was examined in the temperature range 450 to 566 C for times to 100 h. Data from four heats were included. The relaxation strength was found to vary with heat treatment by a factor of three from the weakest to the strongest. The extent of recovery and tempering that occurred during relaxation was displayed by means of isochronous stress vs strain curves constructed from multiple loading tests. Relaxation response after cyclic strain was examined to response after monotonic strain providing that the starting stress was at the tip of the hysteresis loop. The salient features of the relaxation response were consistent with expectations based on a material deformation model that included parameters to accommodate kinematic and istropis hardening. DOE

**N82-14345#** Cambridge Univ. (England). Dept. of Metallurgy and Materials Science.

**ELECTROCHEMICAL ASPECTS OF STRESS-CORROSION CRACKING IN ALPHA-BRASS**

G. T. Burstein and R. C. Newman 1981 11 p refs Presented at Electrochem. Soc. Conf., Denver, 11 Oct. 1981

(Contract DE-AC02-76CH-00016)

(DE81-022078; BNL-29589; CONF-811013-1) Avail: NTIS HC A02/MF A01

A number of aspects of the stress corrosion cracking of brass from the point of view of the localized electrochemical processes occurring at the tip of a propagating crack are investigated. The principal system examined is the intergranular stress (SCC) of 70-30 brass in near-neutral ammoniacal solutions, for which a detailed mechanism is developed. In addition, the effects of nitrite ions in promoting SCC of both brass and copper are considered. . DOE

**N82-14346#** Oak Ridge National Lab., Tenn.

**IDEAL TRANSPORT IN TRANSITION METALS: THE RIGID-MUFFIN-TIN APPROXIMATION AND BEYOND**

W. H. Butler 1981 11 p refs Presented at the Intern. Conf. of Electron Transport in Metals, Ottawa, 13 Aug. 1981

(Contract W-7405-eng-26)

(DE81-028073; CONF-810853-1) Avail: NTIS HC A02/Mf A01

A recent calculation of the electrical and thermal resistivities of Nb and Pd due to electron-phonon scattering is reviewed. This calculation used the rigid-muffin-tin approximation and its results indicate that electron-phonon matrix elements calculated in this approximation are too weak at low momentum transfer. A formalism is developed for calculating the corrections to the rigid-muffin-tin approximation. DOE

**N82-14347#** Battelle Pacific Northwest Labs., Richland, Wash.

**H2S ADSORPTION OF PLASTICITY STRAINED IRON**

M. T. Thomas, D. R. Baer, and R. H. Jones May 1981 8 p refs Presented at the NATO Advan. Study Inst. on Atomistics of France, Corsice, France, 22 May 1981

(Contract DE-AC06-76RL-01830)

(DE81-027996; PNL-SA-9546; CONF-810584-2) Avail: NTIS HC A02/MF A01

Data showing an increased adsorption rate for H2S on plastically strained iron is presented. There has been considerable speculation in the literature concerning the effect of strain on the enhanced corrosion and surface reactivity, but there has been on direct experimental evidence that strain does increase surface reactivity. The possible effects of strain enhanced adsorption on crack initiation and growth, catalytic corrosion, and wear properties of materials were considered. DOE

**N82-14348#** Sandia Labs., Albuquerque, N. Mex.

**VISCOPLASTIC RESPONSE OF BERYLLIUM UNDER SHOCK COMPRESSION**

J. R. Asay, L. C. Chhabildas, and J. L. Wise 1981 4 p refs Presented at the 8th AIRAPT Conf. and the 19th EHPRG Conf., Uppsala, 17 Aug. 1981

(Contract DE-AC04-76DP-00789)

(DE81-028248; SAND-81-0379C; CONF-810827-8) Avail: NTIS HC A02/MF A01

Plane shock wave techniques were used to determine the effective viscosity of beryllium over a range of strain rates. Viscosity coefficients were derived from risetime measurements on steady shock waves produced by initial compression of specimens from the ambient state, and also from measured risetime of reloading waves produced by recompression from the initial shocked state. Recompression experiments indicate an increase in viscosity over that obtained for initial compression. DOE

**N82-14349#** California Univ., Livermore. Lawrence Livermore Lab.

**POLARIZATION STUDY OF HOT CORROSION PHENOMENA IN Ni-Cr ALLOYS**

John J. Truhan and Thomas R. Jeys 17 Aug. 1981 23 p refs Presented at the Conf. on Chem. of Mater. at High Temp., Harwell, England, 7-10 Sep. 1981 Submitted for publication

(Contract W-7405-eng-48)

(DE81-029609; UCRL-85554; CONF-810943-3) Avail: NTIS HC A02/MF A01

Electrochemical polarization was used to study the hot corrosion of nickel chromium binary alloys in molten sodium sulfate at 900 C. The advantages of using this technique to study hot corrosion compared to thermogravimetric analysis include accelerated oxidation by anodic polarization, rapid determination of corrosion rates, and quantitative measures of the stability of protective scales. By systematically studying the effect of alloy composition, the primary mode of corrosion change from nickel oxidation and sulfidation to chromium oxidation was observed. A coherent protective chromium oxide scale forms on alloys containing at least 15 to 20 wt % chromium, and only a marginal increase of protection is realized using additional chromium.DOE

**N82-14350#** Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.

**DISSOLUTION KINETICS DURING LOCALIZED CORROSION**

H. S. Isaacs and R. C. Newman 1981 12 p refs Presented at Electrochem. Soc. Conf., Denver, 11 Oct. 1981

(Contract DE-AC02-76CH-00016)

(DE81-025092; BNL-29580; CONF-811013-2) Avail: NTIS HC A02/MF A01

The dissolution kinetics of iron and cobalt were measured under one dimensional diffusional boundary conditions. Experimental results obtained in aggressive neutral electrolytes show features resulting from transient supersaturation, salt film precipitation

and diffusion controlled dissolution. A mathematical model incorporating these features was applied to metal dissolution in neutral chloride solutions. The effects of sulfur-containing ions on localized dissolution of iron are described with reference to the stress-corrosion cracking of sensitized stainless steels. DOE

**N82-14351#** Fraunhofer Inst. fuer Werkstoffmechanik, Freiburg (West Germany).
**CORROSION AND HIGH TEMPERATURE RESISTANT COATINGS FOR MOLYBDENUM, MADE OUT OF IRON AND NICKEL ALLOYS AND APPLIED BY EXPLOSIVE WELDING [KORROSIONS- UND HOCHTEMPERATURBESTAENDIGE SCHICTEN FUER MOLYBDAEN AUS Fe- UND Ni- BASISLEGIERUNGEN AUFGEBRACHT MITTELS EXPLOSIVPLATTIERUNG]**
R. Pruemmer and R. Henne Apr. 1980 18 p refs In GERMAN
(T-15/80) Avail: NTIS HC A02/MF A01

The impact parameters of the explosive welding of molybdenum with Inconel 601 were determined. The combination Mo and Inconel 601 was considered as nonweldable. It can be applied in solar radiation concentrating devices, allowing a higher operating temperature and higher energy conversion efficiency. The usual velocities of the explosive welding process (collision velocities of 2200 m/sec) lead at best to samples affected by cracks, due to the insufficient workability of molybdenum. At higher velocities cracks no longer occur, molybdenum being a strain rate sensitive material. Layer composite materials can be manufactured in flat as well as in tube form. Author (ESA)

**N82-14352#** Battelle Inst., Frankfurt am Main (West Germany).
**THEORETICAL INVESTIGATIONS ON THE SEPARATION OF IMMISCIBLE ALLOYS Final Report**
Dieter Langbein Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 66 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-004; BF-R-64-152-1; ISSN-0170-1339) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13.90

The physical effects which contribute to the separation of immiscible alloys are discussed and mathematically modeled. Particular attention is given to (1) the mode of cooling, (2) the formation and growth of clusters, (3) free convection, (4) sedimentation, (5) capillary forces, (6) differences in surface tension, (7) differences in interface tension, (8) interface or Marangoni convection, (9) the directed growth of droplets, (10) Ostwald ripening, (11) the overlapping on the impoverished regions around droplets, and (12) the migration of droplets ahead of a solidification front. As it takes at least 20 sec for a metallic melt of 1 cm in diameter to cool down completely, all experiments planned or already conducted under zero-gravity have to be rated at this time interval. Effects (5) to (8) and (11) are fast processes in this sense, all being based on interface phenomena. The tendency of regions of equal concentration or temperature to contract into spheres is demonstrated using the transparent model system methanol/cyclohexane. Author (ESA)

**N82-14353#** Centre Technique des Industries Mecaniques, Senlis (France).
**IONIC TREATMENT OF TOOLS AND GEARS Final Report [TRAITEMENT IONIQUE DES OUTILLAGES ET ENGRENAGES]**
A. Dubus, J. P. Peyre, M. Gantois (Ecole Nationale Superieure de la Metallurgie et l'Industrie des Mines), H. Michel (Ecole Nationale Superieure de la Metallurgie et l'Industrie des Mines), C. Leroy (Ecole Nationale Superieure de la Metallurgie et l'Industrie des Mines), and J. M. Rongvaux (Ecole Nationale Superieure de la Metallurgie et l'Industrie des Mines) 30 Sep. 1980 265 p refs In FRENCH
(CETIM-12-G-129) Avail: NTIS HC A12/MF A01

Ionic nitriding was studied. The diffusion layers were quantitatively and microstructurally analyzed. The fundamental mechanisms which govern the in situ transformation of sulfur carbides into nitrides and lead to the precipitation of cementite lattices are defined. Optimization of the treatment parameters allows for the realization of single-phase layers on Z 155 CDV 12 steel. This phase transformation conditions the mechanical resistance of the nitrided layers. Wear test results indicate that for tool steels, the choice of nitriding treatment must be specific to the intended application. Author (ESA)

**N82-14354#** Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
**FATIGUE CORROSION RESISTANCE OF ALUMINUM ALLOYS [TENUE EN FATIGUE CORROSION DE QUELQUES ALLIAGES D'ALUMINIUM]**
E. Budillon and D. Aliaga 9 Jun. 1981 17 p In FRENCH Presented at 52nd AGARD Conf., Cesme, Turkey, 5-10 Apr. 1981
(SNIAS-812-551-104; C-42087) Avail: NTIS HC A02/MF A01

Fatigue corrosion of light alloys used in aeronautical construction is evaluated. Alloys 2024, 2618, 2214, 6061, 7075, and 7050 are discussed. Dry argon, humid air, and salt water environments were used. Alloys 2618A and 7175 were subjected to additional analysis of crack behavior: with a surface coating; with chromium anode oxidation; and with a coating similar to those used by the aircraft industry. Salt water is the most harmful environment, followed by humid air. The 2000 series alloys are more affected than the 7000 series by these environments. In salt water; however, 2618A shows 25% greater resistance than 7175 to cracks. In normal, and humid air, chromium anode oxidation can adversely affect resistance. Shot blasting beforehand prevents this. In salt water, painting and anode treatment are effective in reducing environmental effects. Author (ESA)

**N82-14355#** Chemical Recovery Systems, Hanover, Maine.
**NICKEL RECOVERY FROM ELECTROPLATING RINSEWATERS BY ELECTRODIALYSIS Final Report**
John L. Eisenmann Jul. 1981 55 p refs Prepared jointly with Risdon Mfg. Co., Waterbury, Conn.
(Grant EPA-R-803742)
(PB81-227209; EPA-600/2-81-130) Avail: NTIS HC A04/MF A01 CSCL 11F

A program to demonstrate the feasibility of metal salt recovery and pollution control on a Watts-type nickel plating line by electrolysis was conducted. Each of two reclaim rinse tanks, arranged in series following plate tanks, was treated by recirculating the rinse solutions through separate electrodialysis stacks. The nickel salts recovered from the rinse solutions were concentrated 20 fold by the electrodialysis treatment, and could be returned directly to the plate tanks for reuse. A cost estimate based on the data obtained during the demonstration indicates that 95% of the nickel lost from untreated rinses could be recovered and that ancillary benefits in sludge disposal, use of treatment chemicals, etc. could be realized. Pay back periods of less than 18 months are anticipated for commercial units. GRA

# 27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

**N82-14356** Polytechnic Inst. of New York, Brooklyn.
**NEW EPOXY RESINS: SYNTHESIS AND STABILITY Ph.D. Thesis**
Chii-Shu Chen 1981 203 p
Avail: Univ. Microfilms Order No. 8118866

A polymer which has high aromaticity and/or cyclic ring structures in the chain backbone usually gives high heat resistance and flame resistance. Five glycidyl ether type epoxy resins are prepared from bisphenol A(DGEBA), 9-9-bis(4-hydroxyphenyl) fluorene (DGEBF), 3,6-dihydroxyspiro [fluorene-9,9'-xanthane] (DGEFX), 10,10-bis(4-hydroxyphenyl) anthrone (DGEA) and 9,9,10,10-tetrakis(4-hydroxyphenyl) anthracene (TGETA) in order to study structure thermal stability-flame resistance property relationships. Various curing agents were evaluated. The char yield at 700 C under a nitrogen atmosphere and the glass transition temperature (Tg) for the cured and uncured resins decrease according to the sequence TGETA > DGEFX > DGEA > DGEBF > DGEBA. The Tg's for these cured epoxy resins are DGEBA > DGEBF > DGEFX > DGEA. A Tg for the TGETA is not

obtainable but would be expected to be the highest. DGEBF, DGEFX, DGEA and TGETA added to the DGEBA system show increases in the char yield, Tg and oxygen index with increasing concentration. Dissert. Abstr.

**N82-14357*#** Toronto Univ. (Ontario). Dept. of Chemistry.
**MODELLING OF POLYMER PHOTODEGRADATION FOR SOLAR CELL MODULES Quarterly Technical Progress Report, 1 Jan. - 31 Mar. 1981**
A. C. Somersall and J. E. Guillet Apr. 1981 17 p ref
(Contract JPL-955591)
(NASA-CR-165041; JPL-9950-615) Avail: NTIS HC A02/MF A01 CSCL 07C

A computer model including an integration routine was developed and demonstrated to simulate, in principle, the chemical changes which may occur in the photooxidation of hydrocarbons, using as input data a set of elementary reactions, corresponding rate constants and appropriate starting conditions. Application of this model to the photooxidation of pottant and plastic materials used in the LSA module designs provides a reliable predictive capability regarding the useful lifetime of these materials. An earlier mechanism consisting of 46 reactions was simplified considerably by reducing the number of formal termination steps since it became apparent that the major termination process goes via the peroxy radicals. In addition, new reactions of oxygen with acryl radicals (from Norrish type I) to form peracids, which then decompose to form carbon dioxide are included. M.D.K.

**N82-14358*#** Toronto Univ. (Ontario). Dept. of Chemistry.
**MODELLING OF POLYMER PHOTODEGRADATION FOR SOLAR CELL MODULES Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1981**
A. C. Somersall and J. E. Guillet Jul. 1981 16 p
(Contract JPL-955591)
(NASA-CR-165040; JPL-955591-81/3; JPL-9950-616) Avail: NTIS HC A02/MF A01 CSCL 07C

A computer program developed to model and calculate by numerical integration the varying concentrations of chemical species formed during photooxidation of a polymeric material over time, using as input data a choice set of elementary reactions, corresponding rate constants and a convenient set of starting conditions is evaluated. Attempts were made to validate the proposed mechanism by experimentally monitoring the photooxidation products of small liquid alkane which are useful starting models for ethylene segments of polymers like EVA. The model system proved in appropriate for the intended purposes. Another validation model is recommended. M.D.K.

**N82-14359*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ULTRASONIC VELOCITY FOR ESTIMATING DENSITY OF STRUCTURAL CERAMICS**
S. J. Klima, G. K. Watson, T. P. Herbell, and T. J. Moore 1981 12 p refs Presented at the Automotive Technol. Develop. Contractor Coord. Meeting, Dearborn, Mich., 26-29 Oct. 1981
(Contract DE-AI01-77CS-51040)
(NASA-TM-82765; DOE/NASA/51040-35; E-1026-5) Avail: NTIS HC A02/MF A01 CSCL 11B

The feasibility of using ultrasonic velocity as a measure of bulk density of sintered alpha silicon carbide was investigated. The material studied was either in the as-sintered condition or hot isostatically pressed in the temperature range from 1850 to 2050 C. Densities varied from approximately 2.8 to 3.2 g cu cm. Results show that the bulk, nominal density of structural grade silicon carbide articles can be estimated from ultrasonic velocity measurements to within 1 percent using 20 MHz longitudinal waves and a commercially available ultrasonic time intervalometer. The ultrasonic velocity measurement technique shows promise for screening out material with unacceptably low density levels. Author

**N82-14360#** Boeing Vertol Co., Philadelphia, Pa.
**LOW-COST FORMING INFLUENCE ON REINFORCED THERMOPLASTIC MECHANICAL PROPERTIES Final Report, Jan. - Dec. 1980**
Donald J. Hoffstedt, Lawrence C. Ritter, and Donald J. Toto Aug. 1981 112 p refs
(Contract DAAG46-79-C-0092; DA Proj. 1L1-62105-AH-84)
(AD-A106004; AMMRC-TR-81-36) Avail: NTIS HC A06/MF A01 CSCL 11C

A study of the influence of low cost forming method on the mechanical properties of reinforced thermoplastics is described. A relationship between processing parameters (time/pressure/temp-variables) and selected material properties (modulus, flex strength, inter-laminar shear strength) is established. The effects (measured by the change in material flexural properties) of simulated solvent attack on painted and unpainted laminates are determined. A review of the available literature on reinforced thermoplastic materials, material properties, and fabrication methods is provided. Four, 16 in x 20 in, five ply Kevlar 49 style 285 fabric, polysulfane, laminated panels for AMMRC testing were manufactured. A decrease in flexural strength readings coming at the 450 F thermoforming temperature is indicated. Modulus values are highest in the 500 F to 550 F thermoforming temperature range. Interlaminar shear strength values also tend to decrease as thermoforming temperature increases. Regarding solvent attack, generally higher flexural strength with polyphenylsulfone than with polysulfone sandwich beams is indicated. Conversely higher 'EI' values occurred in the polysulfone than in the polyphenylsulfone sandwich beams. GRA

**N82-14361#** Space Sciences, Inc., Monrovia, Calif.
**MASS SPECTROMETRIC STUDIES OF THE THERMAL DECOMPOSITION OF SOME AZIDO POLYMETRIC BINDERS Annual Summary Report, 1 Aug. 1980 - 31 Jul. 1981**
Milton Farber and R. D. Vastava Sep. 1981 26 p refs
(Contract N00014-80-C-0711)
(AD-A106090) Avail: NTIS HC A03/MF A01 CSCL 07/4

Thermal decomposition studies were conducted on BAMO, GAP and AZOX. Decomposition was initiated at approximately 120 C, with activation energies for the three materials approximately 170 kJ/mol. The primary mechanism for the decomposition is the release of molecular N2. Secondary decomposition occurring at temperatures above 150 C included the fracturing of the three-carbon backbone of both the polymers and the monomer. Higher decomposition temperature species included HCN, HCO, and smaller amu fragments. Author (GRA)

**N82-14362#** Atlanta Univ., Ga. Dept. of Chemistry.
**LIQUID CRYSTAL BLOCK COPOLYESTERS. 2: PREPARATION AND PROPERTIES OF BLOCK COPOLYESTERS CONTAINING CYCLOHEXANE AND BENZENE RINGS Technical Report, 1 Jan. 1980 - 31 May 1981**
Malcolm B. Polk, Kofi B. Bota, Edmond C. Akubuiro, and Metha Phingbodhipakkiya 28 Sep. 1981 23 p refs
(Contract N00014-80-C-0557)
(AD-A105556; TR-1) Avail: NTIS HC A02/MF A01 CSCL 11/9

Poly oxy-trans- 1,2 -cyclohexyleneoxycarbonyl-trans- 1,2 -cyclohexylenecarbonyl-b-oxy (2-methyl- 1,3 -phenylene) oxyterephthaloyl V; Poly (oxy-trans- 1,4 -cyclohexyleneoxycarbonyl-trans- 1,4 -cyclohexylenecarbonyl-b-oxy- 1,4 -phenyleneoxyterephthaloyl) VI; Poly (oxy-cis- 1,4 -cyclohexyleneoxycarbonyl-trans- 1,4 -cyclohexylenecarbonyl-b-oxy- 1,4 -phenyleneoxyterephthaloyl)-VII; and Poly (oxy-trans- 1,4 -cyclohexyleneoxycarbonyl-trans- 1,4 -cyclohexylenecarbonyl-b-oxy (2-methyl- 1,4 -phenylene) oxyterephthaloyl) VIII have been synthesized and characterized by infrared spectroscopy, nuclear magnetic resonance spectroscopy, differential scanning calorimetry, and viscometry. Block copolymers VI, VII, and VIII form mesomorphic solutions which depolarize plane-polarized light. Author (GRA)

**N82-14363#** Army Materials and Mechanics Research Center, Watertown, Mass.
**ACCELERATION OF THE EPOXY RESIN-DICYANDIAMIDE CURE CYCLE BY TRISUBSTITUTED UREAS Final Report**
Bernard R. LaLiberte, Robert E. Sacher, and Joseph Bornstein Jun. 1981 15 p refs
(DA Proj. 1L1-62105-AH-84)
(AD-A105870; AMMRC-TR-81-30) Avail: NTIS HC A02/MF A01 CSCL 11/9

The addition of accelerators such as Monuron, N-(4-chlorophenyl)-N',N'-dimethylurea, or Diuron, N-(3,4-dichlorophenyl)-N',N'-dimethylurea, to epoxy resin-dicyandiamide mixtures significantly decreases the hardening temperature of

these systems. These trisubstituted urea accelerators are believed to serve mainly as a latent source of dimethylamine. This amine is believed to play a very important role in the cure cycle. One pathway to dimethylamine is a low-temperature cyclocondensation reaction between the trisubstituted urea and the epoxy functionality to form a 2-oxazoli-done; this reaction partially hardens the resin. The significance of this source of dimethylamine in the overall mechanism of epoxy hardening was illustrated by differential scanning calorimetry. Several epoxy formulations were examined at various heating rates. Arrhenius plots of the data indicated that the slope of a two-component mixture consisting of resin and Monuron was approximately the same as that of a three-component system composed of resin, dicyandiamide, and Monuron. In contrast, the slope of a two-component resin-dicyandiamide system was found to be considerably larger. Thus the reaction of Monuron with the resin is an important factor that must be considered in any explanation of the acceleration of the hardening process of dicyandiamide-containing resins.
Author (GRA)

**N82-14364#** Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
**FAILURE PREDICTION IN GLASS Final Report, 1 Jul. 1978 - 30 Jun. 1981**
Robert H. Doremus Jul. 1981 9 p refs
(Contract DAAG29-80-C-0140; Grant DAAG29-78-G-0141)
(AD-A105857; ARO-14889.8-MS) Avail: NTIS HC A02/MF A01 CSCL 09/1

The static fatigue of Pyrex borosilicate glass was measured over a wide range of stress and failure time, and the log failure time was found to be inversely proportional to the applied stress. The appearance of fracture origins was consistent with crack tip sharpening during fatigue, as predicted by the Hillig-Charles theory as modified for different failure time-stress functional relations. An explanation for the sensitivity of fatigue of soda-lime glass to surface treatment was proposed. Author (GRA)

**N82-14365#** National Bureau of Standards, Washington, D.C. Center for Materials Science.
**PYROELECTRICITY AND CHARGE TRANSPORT IN A COPOLYMER OF VINYLIDENE FLUORIDE AND TETRAFLUROETHYLENE**
M. G. Broadhurst, G. T. Davis, A. S. DeReggi, S. C. Roth, and R. E. Collins (Sydney Univ.) 30 Sep. 1981 32 p refs Submitted for publication
(Contract N00014-79-F-0012)
(AD-A105790; TR-15) Avail: NTIS HC A03/MF A01 CSCL 11/9

A copolymer of vinylidene fluoride and tetrafluoroethylene shows pyroelectric and piezoelectric effects after poling. Thermal pulsing measurements indicate that the polarization in this material is highly non-uniform. The piezo/pyroelectric response of this non-uniformly poled copolymer consists of two parts: a rapid response that is the result of changes in internal polarization, and a delayed response due to reversible motion of real charge through the bulk of the material. This model explains previously reported observations of the independence of pyroelectric response over a wide range of poling conditions. Author (GRA)

**N82-14366#** Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
**POLYMERIC MICROELECTRONICS Annual Technical Report, May 1980 - May 1981**
Stephen T. Kowel, Edward Balizer, T. T. Su, I. H. Loh, Dennis Cleverly, George C. Martin, and Philipp G. Kornreich 1 Jun. 1981 235 p refs
(Contract DAAK70-80-C-0053; DA Proj. 1L1-62709-DH-95)
(AD-A105707; TR-81-6) Avail: NTIS HC A11/MF A01 CSCL 11/9

Our basic goal has been to evaluate the suitability of polymer systems for use in adaptive optics. Structures such as the electrostatically controlled mirrors and lenses described in this report require the mating of materials relatively new to electronics applications with microfabrication technology. Microprocessor technology will be essential in electronically calibrating structures with little inherent optical quality. The resultant devices should be small, inexpensive, and should require low power and voltages since no mechanical motion is employed. In the case of deformable mirrors, analysis indicates that elastomer microstructures should be capable of larger deformations than conventional adaptive optical components. Microfabrication creates structures with large area-to-volume ratios. Thus electrostatic forces can overcome inertial forces. We have verified that such materials can be spread in thin sheets and formed into islands smaller than 20 micrometers on a side. The techniques developed depend on using elastomers which can serve as resist. Exposed to ultraviolet light through a mask, they are chemically altered and the unwanted portions can then be washed away. We have also demonstrated that conductive and reflective metal electrodes can be deposited using low temperature conditions. The thin films created should not stiffen the polymer appreciably. Indium is the best material for use in these structures. GRA

**N82-14367#** Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
**EVALUATION OF CLEANING PROCEDURES AND BONDING MATERIALS FOR TPX PLASTIC**
G. L. Flowers and J. L. Montague Sep. 1981 9 p
(Contract DE-AC04-76DP-00487)
(DE82-000048; MHSMP-81-40) Avail: NTIS HC A02/MF A01

TPX plastic parts currently undergo a chromium trioxide acid etch and polyolefin primer application prior to being bonded to LX-17 explosive parts with Exlostik 473. This study evaluates Explostik 473 (epoxy), APC 2.5 (Silicone) and Hexcel Uralite 3121 S (urethane) adhesive several surface treatment. These surface treatments include acid etch; acid etch and polyolefine primer; polyolefin primer; oxygen plasma clean; oxygen plasma clean and polyolefin primer. Results indicate that oxygen plasma cleaning is the best surface treatment. Plasma treatment times as short as 2.5 min do an adequate job. Plasma-treated parts remain clean and bondable for at least 16 days after treatment. GRA

**N82-14368#** Purdue Univ., Lafayette, Ind.
**MECHANISMS OF ELEVATED-TEMPERATURE IN SINGLE PHASE CERAMICS Progress Report, 1 Feb. 1981 - 31 Jan. 1982**
A. A. Solomon Sep. 1981 87 p refs
(Contract DE-AC02-80ER-10591)
(DE82-000691; DOE/ER-10591/2) Avail: NTIS HC A05/MF A01

The quadrupole mass spectrometer system was completed, calibrated, tested, and used to analyze swelling and rupture transients in nickel and UO2. An automatic data acquisition system was also designed and built to feed all temperature, pressure, displacement and released gas signals directly to the PDP-11 computer for data reduction and tabulation. Swelling and gas release studies were completed on Ni and initiated on UO2. A method was developed to fabricate tensile creep specimens of CoO and UO2 using slip-casting and isostatic compaction. The assembly and testing of the thoriated tungsten constant-true-stress creep machine was also completed for testing appropriately shaped specimens. Sintering studies carried out on UO2 in the thoriated tungsten pressure vessel at high ambient pressure indicated that sinterng was impeded in the tungsten vessel. Finally, a system was designed and built to test ceramics under relatively high oxygen pressre. Tensile creep specimens of CoO were produced by oxidation. Tensile creep deformation was performed on two CoO specimens. The results indicate superplastic strains in a porous ceramic under tensile loading. DOE

**N82-14369#** Prins Maurits Lab. TNO, Rijswijk (Netherlands). Inst. for Chemical and Technological Research.
**POROUS POLYMERS AS NEW SORPTIVE MATERIALS**
J. Medema and J. J. G. M. vanBokhoven Oct. 1980 18 p refs
(PML-1980-77; TDCK-75001) Avail: NTIS HC A02/MF A01

Porous polymers are compared with active carbon for the adsorption of harmful compounds from the atmosphere. Factors determining the character of porous polymers are discussed, and results regarding adsorption capacity is described. Literature data and adsorption tests were used. The main factors which characterize the polymer are solvent type and degree of crosslinking. Active groups do not influence the physical adsorption capapcity very much. Water vapor adsorption on porous polymers

is extremly low. The rate of adsorption on a good porous polymer is considerably lower than the rate of adsorption into active carbon. Author (ESA)

**N82-14370#** Environmental Protection Polymers, Inc., Hawthorne, Calif.
**SECURING CONTAINERIZED HAZARDOUS WASTES WITH WELDED POLYETHYLENE ENCAPSULATES Final Report**
H. R. Lubowitz, R. W. Telles, S. L. Unger, and R. R. Phillips Jul. 1981 90 p refs
(Contracts EPA-68-03-2483; EPA-68-03-2993)
(PB81-231292; EPA-600/2-81-139) Avail: NTIS HC A05/MF A01 CSCL 11I

Full scale encapsulation of 208 liter (55 gal) drums was studied as a means of managing corroding containers of hazardous wastes in the field and rendering them suitable for transport and safe deposit within a final disposal site such as a landfill Polyethylene (PE) receivers with 6.35 mm (1/2 in) thick walls and wider mouths were employed for fabricating encapsulates. After insertion of drums, the receivers were weld sealed with 6.35 mm (1/2 in) sheet PE. A light weight prototype apparatus was designed and transportable contructed to fabricate the PE encapsulate by welding. Precision alignment of pieces and high regularity of surfaces to be joined were found to be unnecessary. Furthermore, only minimal mechanical pressures were needed to form the welded joints. Results indicated plastics welding to be an effective method for encapsulating corroding drums of hazardous wastes. DOE

# 28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

**N82-14371*#** United Technologies Research Center, East Hartford, Conn.
**EXTERNAL FUEL VAPORIZATION STUDY Final Report**
E. J. Szetela and J. A. TeVelde Nov. 1981 92 p refs
(NASA-CR-165513; UTRC-81-915326-15) HC A05/MF A01 CSCL 21D

The feasibility of external fuel vaporization in advanced aircraft gas turbine engines is addressed. Experiments were run to determine key fuel properties including boiling points, dew points, critical temperature, critical pressure, heat transfer coefficients, deposit formation rates, and deposit removal in a flowing system. Of particular concern were the heat transfer rate in the heat exchanger and the performance of the orifice used in the throttling process. Three fuels were utilized in the experiments including Jet-A, Experimental referee broad specification fuel, and a premium No. 2 diesel fuel. Engine conditions representing the NASA Energy Efficient Engine at sea level takeoff, cruise, and idle were simulated in the vaporization system and it was found that single phase flow was maintained in the heat exchanger and downstream of the throttle. Deposits encountered in the heat exchanger represented a thermal resistance as high as .0013 sq M K/watt and a deposit formation rate as high as 800 micro-gC/sq cm hr. These values are equivalent to a buildup of 0.055 cm of thickness in 36 hours resulting in a more severe fouling condition than originally anticipated. It was found that the deposit can be removed by cleaning with air at a temperature of 720 K for 10 minutes. R.J.F.

**N82-14372#** Farallones Inst. Rural Center, Occidental, Calif.
**THE PC/ECUADOR BIOGAS PROGRAM: CONSIDERATIONS FOR FUTURE DEVELOPMENT**
Paul R. Warpeha 28 Jun. 1980 25 p Sponsored in part by ACTION/Peace Corps.
(PB81-234783) Avail: NTIS HC A02/MF A01 CSCL 21D

The production of methane fuel and fertilizer through the process of controlled anaerobic decomposition on a decentralized community level technology for rural development is considered. The research, development, and demonstration of biogas technology conducted by the Peace Corps in Ecuador for the past six years is presented. GRA

**N82-14373#** Ballistic Research Labs., Aberdeen Proving Ground, Md.
**EROSIVITY OF LOVA PROPELLANTS**
J. R. Ward, T. L. Brosseau, R. P. Kaste, I. C. Stobie, and B. Bensinger Sep. 1981 30 p refs
(DA Proj. 1L1-62618-AH-80)
(AD-A106081; ARBRL-TR-02368) Avail: NTIS HC A03/MF A01 CSCL 19/1

The erosivity of a series of LOVA propellants was evaluated with the BRL 37-mm blowout gun and with heat input measured in a 105-mm M68 tank cannon. The results in the 37-mm blowout gun suggested that three of the eight propellants were as erosive as M30. Subsequent review of the closed bomb data used to calculate charge weights indicated that it is likely the extraordinary erosivity of these three propellants was caused by overestimating the propellant needed to match peak pressure of M30. Author (GRA)

**N82-14374#.** Department of Energy, Laramie, Wyo. Energy Technology Center.
**SIXTH UNDERGROUND COAL-CONVERSION SYMPOSIUM**
1980 619 p refs Symp. held in Shangri-la, Okla., 13-17 Jul. 1980 Prepared in cooperation with Williams Bros. Engineering Co., Tulsa, Okla.
(DE81-027669; CONF-800716) Avail: NTIS HC A99/MF A01

Department of Energy underground coal gasification (UCG) field programs at different sites are reviewed. Private sector industrial activity in UCG is reported. Mathematical modeling for UCG processes is discussed. Laboratory studies concerning UCG are presented. Environmental studies concerning specific UCG sites are examined. The economics of UCG are addressed. Instruments and controls are considered. General topics relevant to UCG are included. DOE

**N82-14375#** Lincoln Land Community Coll., Springfield, Ill.
**ALCOHOL FUELS GRANT PROGRAM AT LINCOLN LAND COMMUNITY COLLEGE, SPRINGFIELD, ILLINOIS Final Report**
1981 14 p
(Contract DE-FG02-80IR-1855)
(DE82-000744; DOE/IR-10855/T1) Avail: NTIS HC A02/MF A01

Progress in the development of alcohol fuels is reported. A tristar still was produced during demonstrations and workshops. Two cars were converted to run on the fuel produced from the still. Preliminary trials of a converted tractor using ethanol and water are reported. Information on the curriculum developed as part of this program is presented. DOE

**N82-14376#** Dvorak Farms, Inc., Whitelaw, Wisc.
**TECHNICAL AND ECONOMIC FEASIBILITY STUDY FOR A 1,500,000 GALLON PER YEAR ANHYDROUS ETHANOL MANUFACTURING PLANT**
Mar. 1981 170 p refs Prepared jointly with Foth & Van Dyke and Assoc., Inc.
(Contract DE-FG01-80RA-50391)
(DE82-000286; DOE/RA-50391/T1) Avail: NTIS HC A08/MF A01

The objective of this study was to determine whether the most appropriate available technology; present and foreseeable resource, market, finance, and economic conditions in the northeastern Wisconsin area may be combined under the proposed management structure to produce ethanol from biomass with favorable economic and energy related results. The method by which this study was completed was to conduct and document a professional review of each of the above mentioned conditions and factors. Each factor was analyzed at a level of detail sufficient enough to allow a decision to be made relative to eventual plant construction. The original intent of the study was to assess the construction and operation of a plant producing between 1,000,000 and 3,000,000 gallons of ethanol per year. Based on an initial assessment of feedstock availability and market and capital requirements, the plant size to be used in this feasibility

study was set at 1.5 million gallons per year. One of the first steps in the study was to complete an assessment of the amount of waste biomass feedstock available in the study area. Based on this assessment it was determined that approximately 45,000 tons of waste biomass would be available to the plant at the cost of transportation. Subsequent laboratory analyses indicated, though, that the expected ethanol yield from this waste resource would be approximately five gallons per ton or 225,000 gallons per year, which is about 15% of the total annual capacity of the proposed plant. Therefore it was necessary to direct the feasibility study toward a basic plant using corn as a primary feedstock, and waste biomass as a secondary feedstock. GRA

**N82-14377#** Andco Environmental Processes, Inc., Buffalo, N.Y.
**FEASIBILITY STUDY FOR AN ALCOHOL-FUELS PLANT FOR BUFFALO, NEW YORK**
Nov. 1980 369 p refs
(Contract DE-FG01-80RA-50357)
(DE82-000032; DOE/RA-50357/T1) Avail: NTIS HC A16/MF A01

A feasibility study was conducted of a 15,000,000 gal per year anhydrous ethanol plant to be located in the Buffalo area. All major aspects of the construction and operation of the plant were investigated. It is concluded that: (1) the volatile energy situation presents too much of a risk for bankers and investors unless the Department of Energy guarantees that they will purchase any alcohol not sold on the open market at a quaranteed price formula; (2) the complete plant design was prepared and it appears that there is very little technological risk in the process; (3) a suitable plant site is available with all necessary utilities and the plant equipment has been laid out for this site; (4) the plant easily complies with environmental, health, safety and socioeconomic requirements; (5) raw materials consisting of corn and coal are readily available in adequate quantity and at reasonable prices in the Buffalo area; (6) the distillers dried grains and the carbon dioxide can both be sold in their entirety at reasonable prices; and (7) capital cost and operating cost are such that the alcohol plant makes an attractive investment with reasonable payout and profit potential. DOE

**N82-14378#** Oak Ridge National Lab., Tenn.
**NEUTRON PRODUCTION BY PROTONS (190 TO 268 MeV) IN A WATER-COOLED TANTALUM TARGET**
R. G. Alsmiller, Jr., J. Barish, J. M. Barnes, and R. T. Santoro Sep. 1981 17 p refs
(Contract W-7405-eng-26)
(DE81-030628; ORNL/TM-7949) Avail: NTIS HC A02/MF A01

The number of neutrons produced in a water cooled tantalum target, the neutron production spectra, and energy deposition are calculated as a function depth. Protons in the energy range 190 to 268 MeV are incident on the target. DOE

**N82-14379#** Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
**COAL-OIL MIXTURES: AN ALTERNATIVE FUEL FOR THE COMMERCIAL MARKETS AND LARGE RESIDENTIAL MARKETS**
Thomas A. Butcher and Robert J. Isler 1981 29 p refs Presented at the Intern. Conf. on Residential Solid Fuels, Portland, Oreg., 1 Jun. 1981
(Contract DE-AC02-76CH-00016)
(DE81-028335; BNL-29773; CONF-810674-2) Avail: NTIS HC A03/MF A01

Results are presented of a program aimed at promoting wide-spread use of coal-oil mixtures in large residential and commercial sector size oil-fired heating equipment. Fuel properties are discussed including viscosity, heating values, and effect of coal particle size. On-site mixing of COM is not considered practical for users in this size range and a number of central preparation plant projects are in progress. Options for on-site storage including the addition of paddle agitators, recirculation agitation systems, auxiliary tanks, and stable slurries are discussed. Fuel pump, controls, and atomizer modifications will be required as well. Special problems of sootblowers, cyclones, baghouses, and scrubbers are considered. DOE

**N82-14380#** Kerr-McGee Corp., Oklahoma City.
**PROCESS DEVELOPMENT FOR IMPROVED SRC OPTIONS. KERR-MCGEE CRITICAL SOLVENT DEASHING AND FRACTIONATION STUDIES Final Report**
R. A. Baldwin, R. E. Davis, L. D. Gillham, R. C. Janka, R. E. Leonard, and D. E. Rhodes Jul. 1981 108 p refs Sponsored by EPRI
(EPRI Proj. 1134-2)
(DE81-903785; EPRI-AP-1932) Avail: NTIS HC A06/MF A01

The solvent refined coal 1/2 process, a coal liquefaction process which includes Kerr-McGee critical solvent deashing (CSD), was demonstrated in a blocked-out fashion in continuous bench-scale units. It was demonstrated that conventional SRC-I as well as short-residence-time vacuum bottoms could be successfully deashed and fractionated and that the fractionated portion of the soluble coal product, light SRC, could be added to the liquefaction solvent to improve its quality. An amount of light SRC equivalent to that which was initially added to the liquefaction solvent was recovered in the CSD process in most cases to maintain light SRC recycle. It was found that soluble coal product recovery was inversely proportional to the first-stage CSD temperature and that the fractionation step was sensitive to deashing solvent to feed ratio. The SRC-1/2 process was not, however, fully integrated and therefore these results are not necessarily indicative of steady-state conditions. DOE

**N82-14381#** Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
**POTENTIAL SUPPLY OF SYNTHETIC FUELS FROM ALASKAN HYDROELECTRIC POWER AND COAL**
Meyer Steinberg and James R. Powell 1981 15 p refs Presented at the IGRC 1981 Conf., Chicago, 28 Sep. 1981
(Contract DE-AC02-76CH-00016)
(DE81-025743; BNL-29764; CONF-810933-1) Avail: NTIS HC A02/MF A01

It is proposed to develop and utilize the large potential hydroelectric power resources in Alaska to produce hydrogen by the electrolytic decomposition of water and to combine the hydrogen with the large Alaskan coal reserves to produce synthetic liquid and gaseous fuels. It is estimated that in this manner, as much as 1.8 million bbls/day of gasoline or 6.2 billion SCF/day of substitute natural gas can be produced. The existing and projected Alaskan pipelines would provide the means of transporting the fuels to energy consuming load centers in the U.S. This development would move the US a considerable way towards energy independence as well as employing the material resources in Alaska in an efficient manner. DOE

**N82-14382#** Brookhaven National Lab., Upton, N. Y.
**DEVELOPMENT OF A METAL HYDRIDE PROCESS FOR HYDROGEN RECOVERY FROM SUPPLEMENTED NATURAL GAS**
F. Reidinger and F. B. Hill 1981 6 p refs Presented at the 2nd World Congr. of Chem. Engr., Montreal, Canada, 4 Oct. 1981
(Contract DE-AC02-76CH-00016)
(DE81-022685; BNL-29461; CONF-811007-4) Avail: NTIS HC A02/MF A01

A metal hydride hydrogen recovery process which has commercially attanable pretreatment requirements, a thermal reactivation procedure with temperatures not exceeding 500 C with reactivation rquired at intervals of 100 absorption desorption cycles, and an alloy lifetime of the order of 70,000 cycles is described. Mercaptan-alloy interactions are considered. The interaction of CO with the alloy in the presence of hydrogen appears quite complicated. The present work indicates that CO 2 concentrations up to 500 ppM may have negligible effect on the rate of hydrogen absorption after an initial exposure to CO2 and hydrogen. If a slower hydrogen sorption rate can be tolerated then higher CO2 levels may be acceptable. DOE

**N82-14383#** Battelle Pacific Northwest Labs., Richland, Wash.
**BIOMASS ENERGY UTILIZATION IN THE PACIFIC NORTHWEST: IMPACTS ASSOCIATED WITH RESIDENTIAL USE OF SOLID FUELS**
P. Petty, W. Hopp, and A. Chockie May 1981 23 p refs Presented at the 1981 Intern. Conf. on Residential Solid Fuels,

Portland, Oreg., 1 Jun. 1981
(Contract DE-AC06-76RL-01830)
(DE81-029137; PNL-SA-9618; CONF-810674-3) Avail: NTIS HC A02/MF A01

The Pacific Northwest Region, including Washington, Oregon, and Idaho, is the geographic area for which an impact assessment of the residential use of solid fuels is performed. An estimate of the potential energy contained in the fuelwood burned annually and an estimate of the mean conversion efficiency of the regional capital stock of woodburning appliances leads to a reasoned assessment of the contribution of wood energy to the residenital energy use in the region. The use of solid fuels was associated with an increase in the incidence of residential fires nationally. An estimate is made of the economic costs attributable to this source of fire incidence. An additional area of concern relates to the harvesting practices of hundreds of individuals, cutting fuelwood for their own use. Statistics describing injuries and death per Btu in the commercial logging industry are used as a basis for an estimate of injuries and deaths resulting from the increased collection of forest residues and fuelwood by private woodcutters. DOE

**N82-14384#** New Hampshire Univ., Durham. Dept. of Chemical Engineering.
**FUELS AND CHEMICALS MADE FROM SOLAR ENERGY**
V. K. Mathur, F. K. Manasse, and S. Lakshmanan 1981 10 p refs Presented at the 2nd World Congr. of Chem. Engr., Montreal, Canada, 4-9 Oct. 1981
(Contract DE-AC02-79ET-21067)
(DE81-025018; CONF-811007-6) Avail: NTIS HC A02/MF A01

The application of high temperature solar energy for the production of fuels and chemicals from various feed stocks is reviewed. The promises and problems of this technology are highlighted. The two-stage Sun gas process is described. The role of chemical engineers and the future of Sun fuels and chemicals are discussed. DOE

**N82-14385#** Punjab Agriculture Univ., Ludhiana (India). Coll. of Agricultural Engineering.
**ENERGY BALANCE AND UTILIZATION OF AGRICULTURAL WASTE ON A FARM Final Report**
B. S. Pathak, A. P. Bhatnagar, Dalijit Singh, and K. S. Salariya 1980 90 p refs Sponsored in part by Tata Energy Research Inst.
(PB81-229262) Avail: NTIS HC A05/MF A01 CSCL 21D

The possibility of using crop residues and other agricultural works as a renewable energy source is investigated. Some conclusions drawn are: energy requirements of tractor operated farms are only marginally higher than bullock operated farms; the use of commercial fuels for cooking in rural areas is very limited; most crop residues except paddy straw is used for fodder or fuel; farmers use dung as fuels although they know its use as a fertilizer; all energy required by farms could be self-generated; and paddy straw should be burned to produce electricity. GRA

**N82-14386#** Punjab Agriculture Univ., Ludhiana (India). Coll. of Agricultural Engineering.
**STUDIES ON SUGARCANE AS AN ENERGY CROP FOR PUNJAB Final Report**
B. S. Pathak, A. P. Bhatnagar, Dalijit Singh, and K. S. Salariya 1980 25 p refs Sponsored in part by Tata Energy Research Inst.
(PB81-232308) Avail: NTIS HC A02/MF A01 CSCL 21D

The energy costs and returns in the production of sugar cane and its conversion to alcohol, based on data collected from a sugar mill and a brewery, are presented. Author (GRA)

## 31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

**N82-14387** DSM/nv Nederlandse Staatsmijnen, Geleen. Centraal Lab.
**DESIGN OF A CONTROL SYSTEM FOR THE OPTIMUM HEATING OF BATCH REACTORS [ENTWURF EINES REGELSYSTEMS ZUM ANFAHREN VON BATCH-REAKTOREN]**
H. Slangen 28 Nov. 1978 40 p In GERMAN
(MS-1296) Avail: Issuing Activity

A nonlinear and unstable reaction system can be represented as a model of third order, and of fifth order if the reaction conversion degree and the time constant of the temperature measurement are included as variables of state. Standard systems are not optimum, but saving of time with optimum control systems is negligible. However, they allow lower conversion during the heating phase, enabling a better product quality. The most important source of error in practice is the changing time contant of the temperature measurement. The optimum system is bang-bang control, with two control points the location of which is calculated with the help of algebraic exponential system equations, if all variables of state and parameters are known.
Author (ESA)

**N82-14388#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**LA RECHERCHE AEROSPATIALE, BI-MONTHLY BULLETIN NO. 1981-2, MARCH - APRIL 1981**
Claude Sevestre, ed. Sep. 1981 77 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981
(ESA-TT-713) Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

Research in aerodynamics is reported, including: thermal fatigue tests; cryogenic wind tunnels; plate buckling; subsonic flow; thin film transducers for temperature and heat flux measurements; and laser pumping by electron beam discharge. For individual titles, see N82-14389 through N82-14394.

**N82-14389#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**KrF LASER PUMPING BY ELECTRON BEAM DISCHARGE** **c36**
Jean Bonnet, Gerard Fournier, and Daniel Pigache *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 3-7 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

The pumping of excimer lasers used in nuclear fusion and isotope separation is considered. Homogeneous ionization with an electron beam permitted discharge pumping of a KrF laser with a discharge-energy/beam-energy ratio $> 5$. This high value is obtained to the detriment of an energy density and an efficiency which are about half the best values obtained under other conditions. This result does not modify a recent conclusion indicating that an electron beam controlled discharge has no significant advantage over a pure electron beam as regards pumping high energy KrF lasers at high repetition rate.
Author (ESA)

**N82-14390#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**THIN FILM TRANSDUCERS FOR TEMPERATURE AND HEAT FLUX MEASUREMENTS** **c35**
Jean-Claude Godefroy *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 9-19 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

Surface thermometers and fluxmeters in the form of thin films that can be installed without requiring any machining, and which are thin enough not to perturb the flow, are studied as a means for assessing heat exchange particularly in turbomachinery. Thermocouple transducers made of thin layers deposited on a flexible substrate (Kapton) are considered for measurements of low temperatures, in fluctuating mode, and in liquids. At present, technology limits their use to temperatures below 200 C, so for temperatures found on turbine blades, further development is

needed. Spatial analysis of heat exchanges is possible, since the same substrate can receive several transducers. They can be used in cryogenic wind tunnels, or for investigating the local nature of a boundary layer. Author (ESA)

**N82-14391#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

**DESCRIPTION AND NUMERICAL SIMULATION OF THERMAL FATIGUE TESTS ON SMOOTH SPECIMENS** **c39**

Georges Cailletaud, Jean-Pierre Culie, and Henri Kaczmarek *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 21-33 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)

Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

A three bar type thermal fatigue system is described which uses classical tensile-compressive test specimens, but no servohydraulic device and allows stress and strain measurements in the critical zone throughout the lifetime. A nickel based turbine blade alloy was tested at high temperature in order to evaluate, under nonisothermal conditions, behavior and rupture modeling established from simple tests. The analysis is shown together with the elements required for simulation by numerical calculations. Good general agreement between the tests and the calculation results confirms the reliability of the experimental system and the validity of the theoretical models. Author (ESA)

**N82-14392#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

**HOMOGENIZATION METHOD FOR REINFORCED PLATE BUCKLING PREDICTION** **c39**

Pierre Suquet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 35-43 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)

Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

The buckling of reinforced plates, or of bars, with periodic heterogeneties is considered. A theory for a typical plate is developed which defines membrane and flexural deformation. The problem decomposes into a linear problem and a nonlinear one where the only unknown is the flexural displacement. For the postbuckling nonlinear analysis, the bifurcation branch of a homogeneous plate is shown to be a good approximation of the bifurcation branch of a reinforced plate, for a simple critical value. The homogenization method gives satisfactory results when limited to global phenomena, e.g., first buckling modes.

Author (ESA)

**N82-14393#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

**SUBSONIC FLOW IN A CORNER** **c34**

Daniel Arnal and Jean Cousteix *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 45-62 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)

Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

Laminar and turbulent flow, as found e.g., at the wing-fuselage junction, were studied numerically. In laminar flow a vortical system close to the edge disturbs calculations. Modifications to the field of the secondary velocity improve this. Further improvement can be achieved by varying vortex parameters. In the turbulent mode, the anisotropy of the turbulence should be considered in the calculation of the second order vortices, (although here it was ignored, and qualitatively correct results are still obtained). The basic equations are the streamwise momentum equation, the streamwise component of the vorticity equation, and two Poisson-type equations for secondary velocities.

Author (ESA)

**N82-14394#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

**RESEARCH ON AN INDUCTION DRIVEN CRYOGENIC WIND TUNNEL** **c09**

Alain Blanchard, Jean-Bernard Dor, Andre Mignosi, and Jean-Francois Breil *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 63-77 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)

Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

The cryogenitization of an induction driven transonic wind tunnel is discussed. Internal insulation and the design of a liquid nitrogen injection system are considered. A unit of 32 injectors is arranged at the periphery of the first diffuser in two rows. Each injector is controlled by a solenoid valve. Several elements can be brought together at the control point to form a 10 bit digital regulation unit. The nitrogen pulses are kept symmetrical by varying the response time of the solenoid valves. This induction system works well, since the increase in nozzle performance compensates increase of flow in the test section due to the drop in temperature. It should be suitable with nitrogen gas. Composite and homogeneous insulating materials were repeatedly plunged into liquid nitrogen. All reveal defects when exposed to stress induced by differences in the expansion between their internal and external faces. Internal surfaces must be reinforced with polyurethane. Author (ESA)

**N82-14395#** Textron, Inc., Springfield, Vt.

**ULTRA-HIGH SURFACE SPEED FOR METAL REMOVAL, ARTILLERY SHELL**

Richard F. Pugh, Michael R. Walsh, and Raymond F. Pohl (Army Armament Research and Development Command, Dover, N. J.) Dover, N.J. Army Armament Research and Development Command Jul. 1981 310 p

(Contract DAAK10-80-C-0029)

(AD-A103970; ARLCD-CR-81019) Avail: NTIS HC A14/MF A01 CSCL 13/9

Four types of steel (AISI 1340, 4140, 4340, and HF-1) which are commonly used in large caliber projectile manufacture were machined with five types of tools at different hardness ranges representing the as-forged and the heat-treated condition. Results show that machining speeds can be increased significantly over current practice using the present available tooling. Author

**N82-14396#** Honeywell, Inc., New Hope, Minn. Ceramics Center.

**MANUFACTURING METHODS AND TECHNOLOGY FOR PRODUCTION HOT FORGING OF ALKALI HALIDE LENSES Semiannual Progress Reports, 7 Apr. 1980 - 7 Apr. 1981**

William B. Harrison and James D. Weigner 30 Jun. 1981 47 p

(Contract DAAK70-79-C-0138)

(AD-A104643; Rept-47822; SAR-2; SAR-3) Avail: NTIS HC A03/MF A01 CSCL 13/8

The hot-forged-to-shape process was adapted and optimized for the 2 by 3 series/parallel operation. Several of the optimization steps led to major cost reductions and process simplifications, as well as an increase in the potential production volume. Optical testing equipment is under investigation as a means of evaluating the finished lenses in a production environment. The automation of the process is almost complete and will allow for much finer control of the forging process. Author

**N82-14397#** California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.

**DETERMINATION OF AIRLOADS ON CERTAIN AIRPORT TOWERS DUE TO ADDITION OF RADOMES Final Report, Jan. 1979 - Dec. 1980**

Charles D. Babcock and William H. Bettes Aug. 1981 135 p

(Contract DOT-TSC-1633)

(AD-A105854; GALCIT-1020; FAA-RD-81-74; TSC-FAA-81-14) Avail: NTIS HC A07/MF A01 CSCL 17/9

This report presents the results of wind tunnel tests conducted on three different radome configurations mounted atop three different airport tower designs. The wind tunnel tests were conducted on 1/12th scale models. Field tests were conducted on one full-scale radome and tower configuration and the data compared with the wind tunnel data. The data are useful for

comparing the airloads transmitted into an airport-tower roof by the various radomes and for evaluating the effects tower geometry can have on these airloads. Author (GRA)

**N82-14398#** Ministry of Housing, Ottawa (Ontario). Project Planning Branch.
**RESIDENTIAL SITE DESIGN AND ENERGY CONSERVATION. PART 1: GENERAL REPORT**
Jan. 1981 158 p
(DE81-904010; NP-1904010-Pt-1; ISBN-0-7743-6072-0) Avail: NTIS HC A08/MF A01

The energy costs that can be saved by a subdivision design format related to energy conservation that is reasonably acceptable in marketing and aesthetic terms were determined. Six subdivision layouts were designed to densities ranging from 6.5 to 13.6 units per gross acre (1058 to 2232 units) or 16.25 to 34 units per gross hectare. Hourly radiation temperature, and wind characteristics for a year constitute the local climate data base. Six house types (from detached to apartment units) and seventeen basic house designs (mostly picked at random) were used. The method for calculating the set heat load and an analysis of the results are presented. The study shows that by way of the selection of the more energy efficient traditional house designs, orientation of buildings to maximize solar transmission, and landscaping to reduce the effect of wind, there is a possible residential space heating energy saving of up to 20% for a low density housing development. T.M.

**N82-14399#** Naval Sea Command Detachment, Norfolk, Va.
**TEST AND EVALUATION OF THE BELL-HALTER 110-FOOT SURFACE EFFECT SHIP DEMONSTRATION CRAFT Final Report, Feb. - Mar. 1980**
Peter K. Spangler Feb. 1981 211 p refs Sponsored by DOT and Urban Mass Transportation Administration
(Contract MIPR-Z-70099-0-019283-A)
(AD-A099000; USCG-D-13-81) Avail: NTIS HC A10/MF A01 CSCL 13/10

Comparative seaworthiness and towing tests were performed with an 82-foot USCG WPB. Other major test categories yielded speed, range, fuel consumption, directional stability, turning, acceleration, and noise characteristics. Limited maintainability and reliability information was compiled and manning and human factors considerations were studied. The SES craft was operated in sea state 2 at speeds of 29 knots with significant vertical acceleration peaks in the passenger compartment of 0.6 g and in sea state 4 at 26 knots with peaks of 0.5 g. Maximum vertical acceleration peaks under these conditions were 0.9 and 1.5 g's, respectively. The SES craft towed the 82-foot USCG WPB at speeds to 11 knots. The maximum measured calm water speed of the SES was 33 knots at a displacement of 121 long tons and a fuel consumption of 6.9 gallons per nautical mile yielding a top speed maximum range of 672 nautical miles. Turning performance and directional control were maintained during simulated combinations of propulsion and lift engine impairment. Author

**N82-14400#** Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
**CYCLE DESIGN FOR A CRYOGENIC REFRIGERATION SYSTEM FOR FED WITH FORCED-FLOW SUPERFLUID HELIUM THROUGH INTERNALLY COOLED CONDUCTORS**
Joel H. Schultz 1981 19 p refs
(Contract DE-AC02-78ET-51013)
(DE82-000446; DOE/ET-51013/23; PFC/RR-81-29) Avail: NTIS HC A02/MF A01

The system was designed for the specifications of the magnet system of the fusion engineering device (FED). The unusual specification of an internally cooled cabled niobium titanium superconductor at a maximum field of 10 tesla, coupled with high ac losses and high neutron and gamma heating in the toroidal field coils led to the selection of a cooling system with superfluid helium at the inlet to the toroidal field coils. While highly unusual as a coil-cooling concept, the implications for the refrigeration system were not unfavorable and showed several features of interest. Among the favorable comparisons with conventional supercritical flow systems was reduced entropy generation in the coil due to pressure drops. DOE

**N82-14401#** Oak Ridge National Lab., Tenn.
**TEST OF A CRYOGENIC HELIUM PUMP**
J. W. Lue, J. R. Miller, P. L. Walstrom, and W. Herz (Kernforschungszentrum, Karlsruhe, West Germany) 1981 7 p refs Presented at the 1981 Cryogenic Eng. Conf., San Diego, Calif., 10 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028629; CONF-810835-6) Avail: NTIS HC A02/MF A01

The design of a cryogenic helium pump for circulating liquid helium in a magnet and the design of a test loop for measuring the pump performance in terms of mass flow vs pump head at various pump speeds are described. A commercial cryogenic helium pump was tested successfully. Despite flaws in the demountable connections, the piston pump itself has performed satisfactorily. A helium pump of this type is suitable for the use of flowing supercritical helium through internally cooled superconductor magnets. It has pumped supercritical helium up to 7.5 atm with a pump head up to 2.8 atm. The maximum mass flow rate obtained was about 16 g/s. Performance of the pump was degraded at lower pumping speeds. DOE

**N82-14402#** Zeiss (Carl), Oberkochen (West Germany).
**DEVELOPMENT OF NEW PRODUCTION TECHNOLOGIES FOR OPTICAL COMPONENTS WITH SPHERICAL SURFACES Final Report**
Hans-Joachim Juranek Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 68 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-032; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14,30

Spherical surfaces for precision optical components were produced by a two-step method instead of the three-step method. The two-step method is known in ophthalmic optics, but did not succeed in precision optics because of the lack of fast high precision grinding machines. Such a machine was built, using special spindles and numerical control. A computer controlled high precision centering and edging machine was built in order to enhance productivity and accuracy and to enable optical shops to produce even complicated lens shapes in an economical way. Author (ESA)

**N82-14403#** Fritz-Haber-Institut, Max-Planck-Gesellschaft, Berlin-Dahlem (West Germany).
**HELIUM 2 COOLING SYSTEMS FOR LONG TERM MISSIONS IN SPACE: PHASE SEPARATION AND HYBRID COOLING SYSTEMS [HELIUM-2-KUEHLSYSTEME MIT LANGEN STANDZEITEN FUER WELTRAUMANWENDUNGEN: PHASENTRENNUNG, HYBRID-KUEHLSYSTEME]**
G. Klipping, I. Klipping, and Schmidtchen 10 Sep. 1980 50 p refs In GERMAN Report will also be announced as translation (ESA-TT-721)
Avail: NTIS HC A03/MF A01

The suitability of helium 2 (superfluid helium) phase separation and hybrid cooling systems for astronomical and aeronomical observations in space, e.g., infrared radiation, was studied. The different aspects of phase separation under conditions of weightlessness are treated and the active phase separator for a liquid helium cooled infrared observatory for Spacelab, German Infrared Laboratory (GIRL) is described. For long-term (more than one year) applications, a hybrid cooling system is required in which refrigerants boiling at higher temperatures are employed. The suitability of hydrogen and neon were investigated as well as that of a secondary solid refrigerant. Analysis indicates that such a hybrid cooling system, using solid neon, can be realized and has substantial advantages compared with a one-stage He 2 cooling system. Author (ESA)

**N82-14404#** Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium).
**[SCIENTIFIC AND TECHNICAL RESEARCH ACTIVITIES REPORT IN INDUSTRIAL FABRICATION] Annual Report, 1980 [RAPPORT ANNUEL DU COMITE PERMANENT AU CONSEIL GENERAL]**
10 Jun. 1981 39 p refs In FRENCH
Avail: NTIS HC A03/MF A01

Activities in heavy construction and industrial research were reviewed. Foundry works, metal industry, and construction are discussed. Fabrication of mechanical and electrical devices as well as industrial automation and data processing are described. The use of plastics is also dealt with. Author (ESA)

**N82-14405#** Technische Hogeschool, Delft (Netherlands). Lab. for Refrigerating Engineering and Air Conditioning.
**SIMULATION OF TRANSIENT BEHAVIOR OF A COMPRESSION-EVAPORATION REFRIGERATION SYSTEM**
H. Yasuda, C. H. M. Machielsen, S. Touber, S. W. Brok, and M. deBruijn Mar. 1981 97 p refs
(WTHD-133) Avail: NTIS HC A05/MF A01

A mathematical model was developed, which by timewise integration of the governing equations pertaining to each of the components, permits computer simulation of steady state as well as transient behavior of single stage vapor compression systems, as used in refrigeration, air conditioning, and heat pumps. Qualitative (stable behavior, or not) and quantitative conclusions (amplitudes, frequencies) are obtained. Comparison with experimental results for dynamic behavior validates the model. The computer programs are appended. Author (ESA)

**N82-14406#** Sinclair (Benito A.) and Associates, Inc., Los Angeles, Calif.
**INCREMENTAL ANALYSIS OF STRUCTURAL CONSTRUCTION COSTS Final Report**
Apr. 1981 58 p refs
(Contract DTFH61-80-C-00148)
(PB81-234932: FHWA/PL-81/008) Avail: NTIS HC A04/MF A01 CSCL 13B

The analysis was performed by assuming an existing bridge as a prototype and designing eight hypothetical bridges for decreasing design loads. The design load implements and design standards for the hypothetical bridges were developed to reflect the current traffic and construction patterns. Based on a standardized unit cost for materials developed from the unit costs of the prototypes, cost was then allocated to each hypothetical bridge design and bridge loading. The result was that 65 to 88% of bridge costs were incurred by the lightest design loading. However, when the same loading was analyzed at a narrower width it only occurred 53 to 74% of total bridge costs. The effects of increased strength and width requirements of progressively heavier vehicles are included. T.M.

**N82-14407#** Approved Engineering Test Labs., Fullerton, Calif.
**STAGED COLLISION AND DAMAGE DATA. VOLUME 1: REPORT FOR ACCIDENT RECONSTRUCTION OF THIRTY (30) TEST VEHICLES Final Report, Jan. - Dec. 1980**
D. H. Hand Jan. 1981 270 p 2 Vol.
(Contract DOT-HS-6-01477)
(PB81-234072: DOT-HS-805929-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 13L

The test vehicles were impacted tested for compliance with FMVSS 212/219/301-75. As a parallel nonconflicting effort, the test vehicles were instrumented with accelerometers to measure vehicle accelerator resultants. T.M.

**N82-14408#** Approved Engineering Test Labs., Fullerton, Calif.
**STAGED COLLISION AND DAMAGE DATA. VOLUME 2: REPORT FOR ACCIDENT RECONSTRUCTION OF THIRTY (30) TEST VEHICLES Final Report, Jan. - Dec. 1980**
Jan. 1981 277 p 2 Vol.
(Contract DOT-HS-6-01477)
(PB81-234080: DOT-HS-805930-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 13L

Test vehicles were instrumented with accelerometers to measure vehicle accelerator resultants. The vehicles were also identified for residual crush and collision deformation classification (CDC) measurements. GRA

**N82-14409#** Approved Engineering Test Labs., Fullerton, Calif.
**OCCUPANT RESPONSE AND VEHICLE ACCELERATION IN A 30 MPH FRONTAL IMPACT TEST, 1981 FORD F150 CUSTOM EXPLORER STYLESIDE, PICKUP, NHTSA 810602 Final Report, Mar. - Apr. 1981**
D. H. Hand 10 Jun. 1981 107 p
(Contract DOT-HS-9-02273)
(PB81-231045: DOT-HS-805927; Rept-971-3882-37) Avail: NTIS HC A06/MF A01 CSCL 13L

Various impact modes and vehicle types are investigated through staged collisions. The information collected includes occupant injury measurements as well as seat belt loads, and vehicle acceleration. GRA

**N82-14410#** Austin Research Engineers, Inc., Tex.
**RELATING PAVEMENT DISTRESS TO SERVICEABILITY AND PERFORMANCE Final Report**
W. R. Hudson, F. N. Finn, R. D. Pedigo, and F. L. Roberts Feb. 1981 275 p refs
(Contract DOT-FH-11-9393)
(PB81-227852: FHWA/RD-80-098) Avail: NTIS HC A12/MF A01 CSCL 13B

Regression analyses, Markov processes, Bayesian analysis, and utility theory were examined as analytical tools useful in relating distress to performance. Several specific performance models of limited applicability are reported, along with some generally applicable techniques and recommended methods. It is shown that useful relationships can be obtained from existing data and are, in fact, being used in several states and other highway agencies. In each case, however, it is shown that significant improvements in the distress performance relationships are needed which can only be obtained through the conscientious observation of distress and performance of pavements under a variety of environmental and load conditions for a reasonable period of time, e.g., (approximately ten years). T.M.

# 32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

**N82-14411#** SRI International Corp., Arlington, Va.
**FISH RAGU (FISH, RADIO-RECEIVING AND GENERALLY USEFUL)**
R. L. Garwin Aug. 1981 19 p refs
(Contract MDA903-78-C-0086)
(AD-A105505: SRI-JSN-81-64) Avail: NTIS HC A02/MF A01 CSCL 17/2

The concept of using a 50kg self-propelled body as a receiver for VLF signals is presented. This fish would operate a few meters below the surface and communicate to submarine via high frequency acoustics. Zinc oxide batteries provide sufficient power for all of the fish operations including a 24 hour endurance at a 4 knot speed. The fish could also be used as a sonar receiver, a sensor of submarine radiated noise, and as a VHF or UHF receiver. Author

**N82-14412*#** National Aeronautics and Space Administration, Washington, D. C.
**POSSIBILITY OF A NEW APPROACH TO PROCESSING SPACE PULSE RADIO SIGNALS**
A. A. Bocharov Oct. 1981 20 p refs Transl. into ENGLISH of "O Vozmozhnosti Novogo Podkhoda k Obrabotke Kosmicheskikh Impulsnykh Radiosignalov" Rept. PR-605, 1980 p 1-8 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. of Space Research, Academy of Sciences (USSR), Moscow
(Contract NASw-3541)
(NASA-TM-76748; PR-605) Avail: NTIS HC A02/MF A01 CSCL 17B

A approach to the processing of space pulse radio signals, which makes it possible to achieve a high level of time resolution is proposed. The approach is based on the utilization of the Fourier transform of a radio pulse envelope in the interstellar medium effect. The conditions of applicability of the proposed method and the requirements for recording equipment are substantiated. Also indicated is the possibility of obtaining superresolution with the utilization of the given method of signal processing. Author

**N82-14413#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**ANTENNA (SELECTED ARTICLES)**
26 Oct. 1981 54 p refs Transl. into ENGLISH from Antenny (USSR), no. 6, 1969 p 50-59, 89-105
(AD-A107428; FTD-ID(RS)T-1107-81) Avail: NTIS HC A04/MF A01 CSCL 17/2

Two articles discussing antennas are presented. Synthesis of a plane impedance antenna of finite length, and emission of an elementary slot vibrator located in the center of an ideally conducting disk are discussed. For individual titles, see N82-14414 through N82-14415.

**N82-14414#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**SYNTHESIS OF A PLANE IMPEDANCE ANTENNA OF FINITE LENGTH**
V. V. Chebyshev *In its* Antenna (Selected Articles) (FTD-ID(RS)T-1107-81) 26 Oct. 1981 p 1-20 refs Transl. into ENGLISH from Antenny (USSR), no. 6, 1969 p 50-59, 89-105 (For primary document see N82-14413 05-32)
Avail: NTIS HC A04/MF A01 CSCL 17/2

A method is examined for synthesis of an antenna in the form of an impedance band in a unbounded conducting screen, excited by a filament of magnetic current. An expression is obtained which joins the radiation pattern of a very random type. This pattern is described using odd Mathieu's functions, with a distribution of the surface reactance in the limits of the band. N.W.

**N82-14415#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**EMISSION OF AN ELEMENTARY SLOT VIBRATOR LOCATED IN THE CENTER OF AN IDEALLY CONDUCTING DISK**
Yu. V. Pimanov and L. G. Braude *In its* Antenna (Selected Articles) (FTD-ID(RS)T-1107-81) 26 Oct. 1981 p 21-50 refs Transl. into ENGLISH from Antenny (USSR), no. 1969 p 50-59, 89-105 (For primary document see N82-14413 05-32)
Avail: NTIS HC A04/MF A01 CSCL 17/2

The emission of an elementary slot vibrator, located in the center of an infinitely thin ideally conducting round disk, was examined. A solution was obtained on the basis of the Fourier method in the form of series with respect to spheroidal functions. Asymptotic expressions for the field arising in the far zone during excitation of an ideally conducting disk were obtained by an elementary slot vibrator (magnetic dipole) located in the center of the disk on the basis of the solution of an integral equation. During solution it was assumed that the radius of the disk is much greater than the wavelength. N.W.

**N82-14416#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**ANTENNA (SELECTED ARTICLES)**
15 Oct. 1981 97 p refs Transl. into ENGLISH from Antenny (USSR), no. 13, 1971 p 3-48, 56-70
(FTD-ID(RS)T-0943-81) Avail: NTIS HC A05/MF A01

Five articles on antenna design, synthesis and calculation are presented. Coverage includes: (1) phased annular arrays of interacting radiators, (2) critical wave number and wave resistance of a coaxial line, (3) difference direction patterns of spherical antennas, (4) input resistance of a vibrator with dielectric cover, and (5) H plane stepped joint of rectangular waveguides. For individual titles, see N82-14417 through N82-14421.

**N82-14417#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**THE DESIGN OF PHASED ANNULAR ANTENNA ARRAYS OF INTERACTING RADIATORS, EXCITED BY A BUTLER CIRCUIT**
N. P. Polishchuk and D. M. Sazonov *In its* Antenna (Selected Articles) (FTD-ID(RS)T-0943-81) 15 Oct. 1981 p 1-19 refs Transl. into ENGLISH from Antenny (USSR), no. 13, 1971 p 3-48, 56-70 (For primary document see N82-14416 05-32)
Avail: NTIS HC A05/MF A01

An annular antenna array of arbitrary interacting radiators, excited by means of a passive reactive Butler pattern-forming circuit, is discussed. The procedure is given for calculating the phase distribution at the inputs of the pattern-forming circuit, assuring the best root mean square approximation to the direction pattern with maximum efficiency in the given direction. The amplitude distribution is assumed to be uniform. Several numerical examples are given and discussed. N.W.

**N82-14418#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**THE DESIGN OF THE CRITICAL WAVE NUMBER AND WAVE RESISTANCE OF A COAXIAL LINE WITH INTERIOR CONDUCTOR OF CROSS-SHAPED SECTION**
G. P. Koshelev, Yu. B. Korchemkin, and S. I. Shanayev *In its* Antenna (Selected Articles) (FTD-ID(RS)T-0943-81) 15 Oct. 1981 p 20-35 refs Transl. into ENGLISH from Antenny (USSR), no. 13, 1971 p 3-48, 56-70 (For primary document see N82-14416 05-32)
Avail: NTIS HC A05/MF A01

The results of a theoretical investigation of a new waveguide with complicated profile of its cross section are reported. Formulas are derived to calculate the critical wave number and wave resistance for various dimensions of the cross section. The results of a numberical calculation for a broad range of cross sectional parameters are given in the form of graphs, convenient for practical use. N.W.

**N82-14419#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**THE SYNTHESIS OF DIFFERENCE DIRECTION PATTERNS OF SPHERICAL ANTENNAS**
D. I. Voskresenskiy and A. Yu. Grinev *In* is Antenna (Selected Articles) (FTD-ID(RS)T-0943-81) 15 Oct. 1981 p 36-56 refs Transl. into ENGLISH from Antenny (USSR), no. 13, 1971 p 3-48, 56-70 (For primary document see N82-14416 05-32)
Avail: NTIS HC A05/MF A01

The problem of minimization of the lateral space radiation of difference direction patterns of spherical nonsuperdirectional antennas in the form of an idealized continuous system of diffraction-type radiators, arranged on ideally conducting spherical surface is considered. N.W.

**N82-14420#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreignt Technology Div.
**THE CALCULATION OF THE INPUT RESISTANCE OF A VIBRATOR WITH DIELECTRIC COVER BY THE METHOD OF INDUCED EMF**
Yu. N. Sokolov *In its* Antenna (Selected Articles) (FTD-ID(RS)T-0943-81) 15 Oct. 1981 p 57-67 refs Transl. into ENGLISH from Antenny (USSR), no. 13, 1971 p 3-48, 56-70 (For primary document see N82-14416 05-32)
Avail: NTIS HC A05/MF A01

The radiation of a vibrator with dielectric cover, placed in a semiconducting medium is discussed. The field in the dielectric is analyzed. The complete value of the input resistance under the assumption of a sinusoidal current distribution is found.N.W.

**N82-14421#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**ON THE CALCULATION OF THE H-PLANE STEPPED JOINT OF RECTANGULAR WAVEGUIDES**
S. V. Butakova *In its* Antenna (Selected Articles) (FTD-ID(RS)T-0943-81) 15 Oct. 1981 p 68-93 refs Transl. into ENGLISH from Antenny (USSR), no. 13, 1971 p 3-48, 56-70 (For primary document see N82-14416 05-32)
Avail: NTIS HC A05/MF A01

A block diagram of a computer program is considered and numerical results of a calculation by the program for the scattering matrix of a step in a rectangular waveguide are pesented. The balance of active powers of the waveguide structures is shown to be carried out independently of the number of higher types of waves for which an allowance is made in the waveguides between heterogeneities. N.W.

**N82-14422#** Computer Sciences Corp., Falls Church, Va.
**AFCC TECHNICAL REPORT. USE OF SHORT RANGE MODEMS (SRM) Final Report**
L. Rousseau, J. Su, and T. H. Weaver, Jr. Scott AFB, Ill. Electronics Engineering Group (1842nd) 1 Sep. 1981 418 p refs
(Contract F23613-77-D-0011)

(AD-A105597; CSC-79-9) Avail: NTIS HC A18/MF A01 CSCL 17/2

Methods for modelling metallic wire transmission paths and means of assessing the estimated performance of modulation/demodulation short range modem designs over these paths are presented. Author

**N82-14423#** ITT Avionics, Nutley, N.J.

**MODULAR MULTI-FUNCTION MULTI-BAND AIRBORNE RADIO SYSTEM (MFBARS). VOLUME 1: EXECUTIVE SUMMARY Final Technical Report, Mar. 1978 - Jun. 1980**

R. A. Reilly, C. W. Ward, A. Lee, R. Schineller, A. Clemens, W. Robertson, and J. Rome (Lowell Univ.) Wright-Patterson AFB, Ohio AFWAL Oct. 1981 65 p 2 Vol.

(Contract F33615-78-C-1518; AF Proj. 2003)

(AD-A106057; AFWAL-TR-81-1077-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes the results of the first two phases of the MFBARS radio architecture study. This study was aimed at establishing a cost effective and volume-conserving method of integrating tactical CNI avionics equipments. The goal was innovative integration of these systems, by a method which would allow the incorporation of new capabilities and which would take advantage of technological advances, both in-hand and projected within the near-term future (1985). Such integration is needed to reduce spiraling life cycle costs and to alleviate severe hardware space limitation problems in tactical aircraft. During Phase I, a set of viable MFBARS candidate architectures was developed, together with a cost evaluation of these with respect to a government-provided baseline of existing equipment, to allow meaningful comparisons. The three MFBARS architectures proposed during Phase I were keyed to a reasonable expectation of techniques and devices projected to be available when MFBARS advanced development would be initiated in the mide '80's. The three architectures provided a graduated increase in payoff potential with associated increases in technical risk. The Government then selected the most advanced of the three Phase I candidate system architectures for more detailed study.

Author (GRA)

**N82-14424#** ITT Avionics, Nutley, N.J.

**MODULAR MULTI-FUNCTION MULTI-BAND AIRBORNE RADIO SYSTEM (MFBARS). VOLUME 2: DETAILED REPORT Final Technical Report, Mar. 1978 - Jun. 1980**

R. A. Reilly, C. W. Ward, A. Lee, R. Schineller, A. Clemens, W. Robertson, and J. Rome (Lowell Univ.) Wright-Patterson AFB, Ohio AFWAL Jun. 1981 231 p 2 Vol.

(Contract F33615-78-C-1518; AF Proj. 2003)

(AD-A106052; AFWAL-TR-81-1077-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 17/2

A top down, system oriented study of the selected system approach was conducted. System configuration details and performance parameters were refined. In addition, to minimize system development risk and to provide guidance on the best direction among which MFBARS should proceed, recommended plans were defined for development of the system and supporting technology. Emphasis is placed on the final recommended development plans. T.M.

**N82-14425#** Colorado Univ. at Boulder. Electromagnetics Lab.

**RADIATION LOSS FROM A CURVED DIELECTRIC CHANNEL WAVEGUIDE IN A DENSE SUBSTRATE**

Edward F. Kuester, Robert L. Holland, and David C. Chang Jun. 1981 86 p refs

(Grant DAAG29-78-G-0173)

(AD-A105928; ARO-15632.5-EL; SR-64) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report gives the results of an investigation to analytically determine the effect of a plane dielectric interface upon the radiation loss of a curved channel dielectric waveguide embedded in a dense substrate and bent in a plane parallel to that of the material interface. The radiation loss from bent dielectric waveguides is of interest for a variety of potential applications in integrated optics. Knowledge of the factors influencing the radiation from bend dielectric waveguides will allow the design of integrated optical component characteristics which, in one application, may result in decreased radiation to conserve signal energy or which, in another application, may achieve enhanced radiation effects in order to optimize the coupling between various optical waveguides. An obvious example for which the conservation of signal energy is of prime concern is the dielectric fiber transmission line used in simple point-to-point data transfer applications. Author (GRA)

**N82-14426#** General Electric Co., Syracuse, N.Y. Military Electronic Systems Operation.

**MANUFACTURING TECHNOLOGY STUDY ON RADIO FREQUENCY POWER MODULES PACKAGING TECHNIQUES Final Report, Sep. 1979 - Jun. 1981**

1981 220 p refs

(Contract N00039-79-C-0378)

(AD-A105892) Avail: NTIS HC A10/MF A01 CSCL 17/9

Program requirements cover manufacturing methods and technology encompassing a determination of materials, processes, and related techniques to improve producibility thereby enhancing manufacturing methods to achieve a significant reduction in production cost of R.F. Power Amplifier Modules. The requirement includes the fabrication and test of proof of process of 25-100 watt R.F. Microwave Hybrid Modules. The foregoing amplifiers featured the enhanced materials, processes, and techniques evolved under this program which achieved reduction of total cost of product. The achieved design is directly applicable to the production design of the AN/TPS-59 Solid State Radar system with direct benefit to a wide family of other Solid State Radars and other systems which may use similar R.F. Power Modules. Because several hundred of these R.F. power modules are used per system, the cost savings resulting from this program are significantly multiplied and provide a very favorable payback on MM&T investment. At the outset of the program, the materials, manufacturing and test/tune methods being used for fabricating power modules at that time were reviewed with respect to their yielded final cost. GRA

**N82-14427#** Orincon Corp., La Jolla, Calif.

**ADAPTIVE ENHANCEMENT OF FINITE BANDWIDTH SIGNALS IN WHITE GAUSSIAN NOISE Final Report, Jan. 1979 - Jun. 1981**

C. M. Anderson, E. H. Satorius, and J. R. Zeidler 15 Aug. 1981 40 p refs Prepared jointly with Naval Ocean Systems Center and sponsored by Naval Electronic Systems Command and Naval Sea Systems Command, Washington, D.C.

(Contract N66001-79-C-0204; XF11101100)

(AD-A105873; NOSC-TR-711) Avail: NTIS HC A03/MF A01 CSCL 09/4

The steady-state behavior of the adaptive line enhancer (ALE) is analyzed for stationary inputs consisting of finite signals embedded in a white Gaussian noise (WGN) background. Analytic expressions for the weights and output of the LMS adaptive filter are derived as functions of input signal bandwidth and SNR, as well as ALE length and bulk delay. The steady-state gain in broadband SNR from input to output is derived as a function of these same four variables. For fixed ALE parameters and input SNR, it is shown that this gain increases as the input signal becomes narrower and approaches the sinusoidal unit. It is emphasized that because the correlation time of finite bandwidth signals is limited, excessively large values of the ALE bulk delay parameter result in diminished gain. Furthermore, there is an optimal filter length, whose value depends upon signal bandwidth and SNR, for which the broadband gain is maximized. These results demonstrate the importance of including the effects of algorithm noise in analyzing the performance of real-time adaptive processors. Author (GRA)

**N82-14428#** Ohio State Univ., Columbus. Electroscience Lab.

**A USER'S MANUAL FOR: ELECTROMAGNETIC SURFACE PATCH CODE (ESP)**

E. H. Newman Jul. 1981 75 p refs

(Contract DAAG29-81-K-0020)

(AD-A105954; ESL-713402-1; ARO-17446.1-EL) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report is a code manual for the Electromagnetic Surface Patch Code (ESP). The code can find the radiation and scattering from geometries consisting of rectangular plates, thin wires, wire/plate junctions and plate/plate junctions. Author (GRA)

**N82-14429#** Institute for Telecommunication Sciences, Boulder, Colo.
**SHF-EHF PROPAGATION THROUGH VEGETATION ON COLORADO EAST SLOPE Final Report, 1 Jan. - 31 Oct. 1980**
Edmond J. Violette, Richard H. Espeland, Albert R. Mitz, Frank A. Goodknight, and F. Schwering Fort Monmouth, N. J. Army Communications Electronics Command Jun. 1981 107 p refs
(DA Proj. 1L1-61102-AH-48)
(AD-A105672; CECOM-81-CS020-F) Avail: NTIS HC A06/MF A01 CSCL 20/14

An SHF/EHF measurement program was conducted to determine the effects on propagation through vegetation common to the Colorado East Slope. Presented in this report are the frequency dependence of vegetation losses, polarization, depolarization, and backscatter on observed signal amplitude for three deciduous tree paths, two conifer tree paths, and one grass path at 9.6, 28.8, and 57.6 GHZ. Some of the variables for these measurements were foliage depth, antenna position, antenna pointing, and antenna beamwidth. Time series data showing scintillation due to wind is displayed and discussed. A single rain event and a single snow event were recorded. Summer foliage measurements were compared to a wintertime defoliated state with identical terminal locations used for each condition. Author (GRA)

**N82-14430#** Norden Systems, Inc., Norwalk, Conn.
**HIGH CONTRAST CRT MODULE Interim Technical Report, 1 Apr. - 30 Sep. 1980**
Michael H. Kalmanash Aug. 1981 43 p refs
(Contract DAAK20-79-C-0290; DA Proj. 1L2-63742-DF-32)
(AD-A106079; Rept-1310-R-0025; DELET-TR-79-0290-2) Avail: NTIS HC A03/MF A01 CSCL 17/2

The objective of this program is the development of a miniature high contrast color CRT module compatible with the AN/APR-39 system, except for an increase in overall length compared to the monochrome AN/APR-39 display indicator. The second interim period of this program has resulted in completion of the electrical and mechanical design of the Advanced Development Module (ADM) and initial ADM fabrication. Author (GRA)

**N82-14431#** Illinois Univ. at Urbana. Electromagnetics Lab.
**INVESTIGATION OF TRANSFORM TECHNIQUES FOR SOLVING ELECTROMAGNETIC RADIATION AND SCATTERING PROBLEMS Final Report, 1 Mar. 1979 - 31 Dec. 1980**
S. W. Lee, R. Mittra, and W. L. Ko Apr. 1981 127 p refs
(Contract N00014-75-C-0293)
(AD-A105664; UIEM-81-3; UILU-ENG-81-2544) Avail: NTIS HC A07/MF A01 CSCL 20/14

In this report we summarize the research performed under the ONR Grant N00014-75-C-0293 during the calendar years 1979 and 1980. We described a number of electromagnetic scattering problems which we have solved using the spectral domain methods. Among these are the frequency selective surfaces, leaky-wave antennas on dielectric waveguides and arbitrarily shaped conducting or dielectric scatterers.
Author (GRA)

**N82-14432#** California Univ., Berkeley. Lawrence Berkeley Lab. Lighting Systems Research.
**ELECTROMAGNETIC INTERFERENCE (EMI) MEASUREMENTS OF FLUORESCENT LAMPS OPERATED WITH SOLID-STATE BALLASTS**
A. Arthur, R. Verderber, F. Rubinstein, and O. Morse May 1981 9 p refs Presented at IEEE/Indus. Appl. Soc. Ann. Meeting, Philadelphia, 5-9 Oct. 1981
(Contract W-7405-eng-48)
(DE81-025218; LBL-12462; CONF-811017-1) Avail: NTIS HC A02/MF A01

Solid state ballasts were placed in fluorescent lamps in various areas of a hospital to determine if these high frequency systems would adversely any hospital operations. The general areas tested included a lobby and an office space. Potentially sensitive areas containing hospital diagnostic and monitoring equipment, including a computerized axial tomography (CAT) scanning room, an electroencephatograph (EEG) examination room, and a coronary ward were also tested. The measurement techniques are described and the results discussed with respect to the existing RFI environment and with respect to EMI radiated and conducted limits specified by the Federal Communications Commission and the Federal Drug Administration. DOE

**N82-14433#** Standard Elektrik Lorenz A.G., Stuttgart (West Germany). Entwicklung Uebertragungsysteme.
**STUDY ON DIGITAL TELEVISION TRANSMISSION VIA A TELEVISION BROADCASTING SATELLITE (TV-SAT) Final Report, Mar. 1980**
Roland Burkhardt, Hans-Christian Dinglinger, Rudo Faelker, Alfred Kemper, Helmut Mitschke, Wolfram Schildauer, Josef Wasser, and Wilmut Zschunke (Uebertragungstechnik und Elektroakustik) Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 124 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-18; ISSN-0170-1339) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 26

Digital transmission and signal encoding methods with redundancy reduction were investigated for a television downlink from a satellite to the home receiver as an alternative method to analog FM transmission, the main criteria being bandwidth, carrier to noise ratio, picture quality and equipment costs at the receiving end. Digital PCM encoded and four phase shift key modulated transmission with a bandwidth of 22.4 MHz, giving very good picture quality, is proposed as advantageous for signal reception with small antennas. An alternative two channel transmission with 27 MHz bandwidth, using a higher order modulation method, is discussed. However, this proposal calls for a higher receiving antenna performance and is thus suitable for community antenna systems only. Author (ESA)

**N82-14434#** Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
**[ACTIVITIES OF THE DEPARTMENT OF SYSTEMS AND COMMUNICATIONS] Annual Report, 1980-1981 [PRESENTATION ET COMPTE RENDU D'ACTIVITES]**
Mar. 1981 122 p refs In FRENCH
(ENST-D-81003) Avail: NTIS HC A06/MF A01

Systems theory, signal processing, and communication theory were studied. Signal analysis, synthesis, transmission and coding was investigated. The contribution of rapid development in integrated circuits to the mathematical analysis of communication problems is emphasized. Author (ESA)

**N82-14435#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 4: Microwaves.
**RESULTS OF THE PROPAGATION MEASUREMENTS AT 94 GHz OVER A 935 M LINK ON THE YPENBURG AIRFIELD**
C. D. deHaan Oct. 1979 52 p refs
(PHL-1979-43; TDCK-73422) Avail: NTIS HC A04/MF A01

Extremely high frequency propagation data and meteorological measurements, including rain rate along the propagation path, windspeed and wind direction in the horizontal plane, the atmospheric temperature, pressure and humidity and raindrop size distribution are given for a vertically polarized Cassegrain antenna link. Actually measured raindrop size distribution and spherical raindrops, were used to measure the attenuation caused by rain using Mie's scattering theory for water spheres. It is noted that in fog, the attenuation is small for millimeter waves and high for infrared waves. Data are collected from point visibility meters, ombrometers and rapid response rain gages.
Author (ESA)

**N82-14436#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 4: Microwaves.
**FURTHER RESULTS OF THE PROPAGATION MEASUREMENTS AT 94 GHz OVER A 935 m LINK ON THE YPENBURG AIRFIELD**
J. H. Buijs Dec. 1980 22 p refs
(PHL-1980-46; TDCK-75028) Avail: NTIS HC A02/MF A01

The effects of rain, snow, and wet snow on vertically and horizontally polarized Cassegrain antenna link 94 GHz waves are reported. Data were collected from point visibility meters, ombrometers, and rapid response rain gages. It is noted that

water effect is the same in both cases. Rain effect is described by the calculated rain attenuation based on measured drop size distributions and spherical raindrops. Snow gives a slightly higher attenuation than rain at the same equivalent rain rate for vertical polarization. Author (ESA)

**N82-14437#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 4: Microwaves.

**A TRANSMITTING SOLID STATE LINEAR PHASED ARRAY ANTENNA FOR C BAND**

P. Doelman and W. P. M. N. Keizer Feb. 1980 60 p refs (Contract A78/K/040)

(PHL-1980-10; TDCK-73844) Avail: NTIS HC A04/MF A01

An IMPATT diode transmiter phased array module, delivering 60 mW power at 5.75 GHz, was built. The oscillators in the transmitting modules consist of IMPATT diode sources and serve as injection locked elements in the antenna system. Details of the design and performance of the transmitter and its component parts, all constructed in microstrip, are given. Results for an antenna provided with eight transmitting modules, injection locked to a reference source, show that the measured radiation characteristics are in excellent agreement with those calculated. Loss in antenna gain due to mutual coupling is less than 2.6 db compared to broadside, for scan angles between 30 and 150 deg in the H plane. Author (ESA)

**N82-14438#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

**ON THE ACCURACY OF RADIO LOCATION IN MEDIA WITH INDIRECT WAVE PROPAGATION**

Emil Sappl Dec. 1980 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-729)

(DFVLR-FB-81-02) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8,10

The elimination of the errors of position determination systems, by appropriate evaluation of the measurements is based on radio frequency range measurements and operating in urban areas. Based on the statistical properties of the errors, the lower limit for the final position error is found which cannot be improved by any evaluation method. This limit is calculated for a system with four reference points at the corners of a square.

Author (ESA)

**N82-14439#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronik.

**RESULTS OF A SLANT RANGE VISIBILITY FIELD EXPERIMENT WITH THE MODIFIED DFVLR-MINILIDAR**

Christian Werner Jan. 1981 21 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-731)

(DFVLR-Mitt-81-01) Avail: NTIS HC A02/MF A01; DFVLR, Cologne DM 5,60

The modified minilidar was used for a slant visual range experiment. The measured lidar visibility values were compared with: (1) in situ measurements from different heights above ground, using an instrumented tower; and (2) a slant installed transmissometer. The possibilities of the lidar two point method for practical application are shown. Author (ESA)

**N82-14440** Georgia Inst. of Tech., Atlanta.

**THE ECCENTRICALLY INSULATED CIRCULAR-LOOP ANTENNA AND THE HORIZONTAL CIRCULAR-LOOP ANTENNA NEAR A PLANAR INTERFACE Ph.D. Thesis**

Lam Nhat An 1981 205 p

Avail: Univ. Microfilms Order No. 8124280

The analysis for the circular loop antenna in a concentric insulating sphere was extended to the case where the loop is eccentrically located in the sphere. Both the transmitting and receiving antennas were treated using the Debye potentials and the Fourier series expansion method. Parametric studies were used to determine the effect of the electrical size of the loop and sphere, the eccentricity and the electrical properties of the media on the directivity of the antenna. The solution to the problem of an eccentrically insulated antenna was extended to obtain the solution to the problem of a loop antenna near a material interface. Specifically, the radius of the insulating sphere is allowed to increase to infinity while the loop is kept at a constant distance from the surface of the sphere. Dissert. Abstr.

**N82-14441** California Univ., Los Angeles.

**ANTI-JAM ANALYSIS OF FREQUENCY HOPPING M-ARY FREQUENCY SHIFT KEYING COMMUNICATION SYSTEMS IN HIGH FREQUENCY RAYLEIGH FADING CHANNELS Ph.D. Thesis**

Dan Avidor 1981 157 p

Avail: Univ. Microfilms Order No. 8122799

The performance of such systems over High Frequency (HF) sky wave channels, when subjected to intentional jamming, were studied. The channels considered are characterized by Rayleigh fading and additive Gaussian noise. To combat jamming the communication system hops over the total spread spectrum bandwidth, which is many times larger than the instantaneous bandwidth occupied by the MFSK signal. Located within the HF band and using sky wave as the dominant propagation mode, the spread spectrum bandwidth is typically nonuniform, time dependent, and congested by many other users of the electromagnetic spectrum in such an environment. Frequency Hopping (FH) MFSK systems seem to be more practical than direct sequence spectrum spreading techniques. A FH/MFSK system can be easily programmed to use a noncontiguous band, thereby avoiding strong interfering signals (which are usually narrow band signals) of friendly signals that should not be interfered with. Dissert. Abstr.

**N82-14177#** Telespazio, S.p.A., Rome (Italy).

**ATTENUATION STATISTICS OBTAINED WITH OTS**

P. Ferrazzoli, G. Brussaard (ESTEC, Noordwijk, Netherlands), L. Piccolomini, and A. Laloux (Univ. Catholique de Louvain, Belgium) *In* ESA OTS: 3rd Year in Orbits Aug. 1981 p 18-21 refs (For primary document see N82-14173 05-12)

Avail: NTIS HC A10/MF A01

**N82-14178#** British Telecommunications Research, Ltd., Taplow (England).

**DEPOLARIZATION MEASUREMENTS AT 11 AND 14 GHz WITH OTS**

J. Thirlwell and N. J. McEwan *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 22-32 refs Prepared in cooperation with Bradford Univ., England (For primary document see N82-14173 05-12)

Avail: NTIS HC A10/MF A01

**N82-14179#** Swedish Telecommunications Administration, Farsta.

**CORRELATING OTS BEACON MEASUREMENTS WITH RADIOMETER AND RAINFALL DATA**

Lennart Hansson *In* ESA OTS: 3rd year in Orbit Aug. 1981 p 33-36 refs (For primary document see N82-14173 05-12)

Avail: NTIS HC A10/MF A01

**N82-14180#** Interim Eutelsat, Paris (France).

**IMPACT OF OTS PROPAGATION RESULTS ON THE ECS SYSTEM**

J. Dutronc and J. C. Raison *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 37-40 ref (For primary document see N82-14173 05-12)

Avail: NTIS HC A10/MF A01

**N82-14182#** European Space Agency, Noordwikj (Netherlands).

**RESULTS OF TESTS ON THE SATELLITE SPOTBEAM ANTENNA**

N. Neale, P. Daly, and L. vanHoltz *In its* OTS: 3rd Year in Orbit Aug. 1981 p 48-52 ref (For primary document see N82-14173 05-12)

Avail: NTIS HC A10/MF A01

**N82-14183#** Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

**RESULTS AND CONCLUSIONS FROM THE RF CLASSICAL TRANSMISSION TESTS FROM THE POINT OF VIEW OF THE TELECOMMUNICATION AUTHORITIES**

H. Kleinschmidt, J. LeLigne (Centre National d'Etudes des Telecommunications), E. Saggese (Telespazio Spa), Y. Tharaud

(Centre National d'Etudes des Telecommunications), and P. Tutton (British Telecom International) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 53-55 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14184#** Filtronic Components Ltd., Leeds (England). ESA Communications Satellite Dept.
**RESULTS AND CONCLUSIONS OF RF PERFORMANCE TESTS MADE BY ESA**
C. D. Hughes and R. A. Gough *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 56-64 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14185#** British Telecom International (England).
**RESULTS AND CONCLUSIONS OF THE 60 MBIT/SEC DIGITAL TRANSMISSION TESTS**
D. Prouse *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 65-68 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14186#** Telespazio, S.p.A., Rome (Italy).
**RESULTS AND CONCLUSIONS OF THE 120 AND 180 MBIT/SEC DIGITAL TRANSMISSION TESTS**
A. Vernucci *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 69-73 Sponsored by Interim Eutelsat (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14187#** European Space Agency, Paris (France). OTS-TDMA Experimenters Group.
**TDMA/DSI SYSTEM TESTS AND TELEPHONY CHANNEL TESTS VIA THE ORBITAL TEST SATELLITE (OTS)**
A. Bernard, T. Hentrich, H. Jack, A. Patacchini, D. Prouse, and N. Deacon *In its* OTS: 3rd Year in Orbit Aug. 1981 p 74-78 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14188#** British Telecom International (England).
**RESULTS AND CONCLUSIONS FROM TELEPHONE SIGNALING TESTS THROUGH TDMA/DSI SYSTEM**
M. L. Kerridge *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 79-82 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14189#** Telespazio, S.p.A., Rome (Italy).
**ANALOGUE TELEVISION TESTS**
V. Speziale, Y. Tharaud (Centre National d'Etudes des Telecommunications), and D. C. Savage (British Broadcasting Corp.) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 83-88 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14190#** Independent Broadcasting Authority, Winchester (England).
**EXPERIMENTAL DIGITAL TELEVISION TRANSMISSIONS THROUGH THE OTS**
D. K. W. Hopkins (British Broadcasting Corp.), D. W. Osborne, N. D. Wells, and E. J. Wilson (British Broadcasting Corp.) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 89-92 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14191#** Independent Broadcasting Authority, Winchester (England).
**DIRECT BROADCASTING EXPERIMENTS WITH OTS: RESULTS OF PICTURE TRANSMISSION TESTS**
D. C. Griffiths (Radiotelevisione Italiana) and R. Orta *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 93-99 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14192#** Institut fuer Rundfunktechnik, Munich (West Germany).
**DIRECT BROADCASTING EXPERIMENTS WITH OTS: RESULTS OF SOUND TRANSMISSION TESTS**
C. Dosch and J. Georgy (Telediffusion de France) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 100-104 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14193#** Radiotelevisione Italiana, Milan (Italy).
**TELETEXT AND DATA BROADCASTING EXPERIMENTS WITH OTS**
R. Orta and D. Pommier (Centre Commun d'Etudes de Television et de Telecommunications) *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 104-107 refs (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

**N82-14197#** European Space Agency, Noordwikj (Netherlands).
**STELLA AND SPINE DATA TRANSMISSION EXPERIMENTS: PRELIMINARY RESULTS AND CONCLUSIONS**
P. Bartholome, M. G. N. Hine (European Organization for Nuclear Research), and J. O. Scalan (Univ. College, Dublin) *In its* OTS: 3rd Year in Orbit Aug. 1981 p 128-131 ref (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

# 33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

**N82-14442** Stanford Univ., Calif.
**BROADBAND MONOLITHIC SEZAWA WAVE STORAGE CORRELATORS AND CONVOLVERS Ph.D. Thesis**
John Edward Bowers 1981 217 p
Avail: Univ. Microfilms Order No. 8124041

A number of different techniques to obtain wide bandwidth, monolithic SAW devices are compared using a more exact theory than was to obtain the bandwidth insertion loss relationship for interdigital transducers. The optimum approach considered here for obtaining acoustoelectric devices using planar processing is the use of the second order Rayleigh mode, commonly called the Sezawa mode, in ZnO/Si devices. Sezawa wave convolvers with -50 dBm efficiency were constructed and demonstrated in compression experiments. The mechanism causing saturation of the convolution efficiency at high power levels was examined and found to be due to charging up of the diodes in diode convolvers, and surface state charging in Sezawa wave convolvers without diodes. Dissert. Abstr.

**N82-14443#** Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Chemistry.
**PREPARATION, THERMAL PROPERTIES, SOLID SOLUTION FORMATION AND SOME LUMINESCENCE PROPERTIES OF RARE EARTH OXYSULFIDES Ph.D. Thesis**
Markku Leskela 1980 39 p refs
(ISBN-951-751-949-4; RP-64) Avail: NTIS HC A03/MF A01

The preparation of rate earth oxysulfides, including their solid solutions, was studied, with particular attention to a method involving reduction of corresponding sulfites in carbon monoxide atmosphere. The thermal stability of the different phase and their oxidation products is noted. A method based on the luminescence lifetime of Eu(3+)luminescence for the determined of the activator concentration in europium activated yttrium oxysulfide is introduced. The effect of host cation solid solution on the intensity and life-time of europium luminescence is discussed. The effects of the host lattice, impurities, activator concentration, and particle size on the luminescene spectra and reviewed for europium activated yttrium oxysulfide, Eu(3+)iY2O2s. S.L.

**N82-14444*#** McDonnell-Douglas Astronautics Co., St. Louis, Mo.
**RELIABILITY STUDY OF OPTO-COUPLED SEMICONDUC-**

**TOR DEVICES AND LIGHT EMITTING DIODES (LED) Final Technical Report, Oct. 1974 - Oct. 1977**
R. C. Maurer, V. A. Weissflug, and E. V. Sisul Oct. 1977 256 p refs
(Contract NAS8-30777)
(NASA-CR-161923) Avail: NTIS HC A12/MF A01 CSCL 09C

Opto-coupler and light emitting diode (LED) failure mechanisms and associated activation energies were determind from the results of environmental and accelerated lift tests of over 2,400 devices. The evaluation program included LED phototransistor opto-couplers from three sources, LED photoamplifier opto-couplers from a single source, and discrete infrared emitting LEDs from two sources. Environmental tests to evaluate device mechanical integrity included power cycling (10,000 cycles), temperature cycling (500 cycles) and a sequence of monitored shock, monitored vibration and constant acceleration. Multiple temperature operating life tests were conducted at ambient temperatures between 25 C and 200 C. Opto-couplers were operated in both the 'on' and 'off' states during life testing. Author

**N82-14445#** Technische Hogeschool, Delft (Netherlands).
**INTEGRATED CIRCUITS FOR ACCURATE LINEAR ANALOGUE ELECTRIC SIGNAL PROCESSING Ph.D. Thesis**
J. H. Huijsing 1981 229 p refs
Avail: NTIS HC A11/MF A01

The main lines in the design of integrated circuits for accurate analog linear electric signal processing in a frequency range including DC are investigated. A categorization of universal active electronic devices is presented on the basis of the connections of one of the terminals of the input and output ports to the common ground potential. The means for quantifying the attributes of four types of universal active electronic devices are included. The design of integrated operational voltage amplifiers (OVA) is discussed. Several important applications in the field of general instrumentation are numerically evaluated, and the design of operatinal floating amplifiers is presented. S.L.

**N82-14446#** Helsinki Univ. of Technology, Espoo (Finland).
**OPTIMAL VOLTAGE LEVEL CONTROL AND ITS APPLICATION TO LONG RANGE EXTENSION PLANNING IN HIGH VOLTAGE TRANSMISSION NETWORK Ph.D. Thesis**
Yrjo Laiho 6 Mar. 1981 136 p refs Sponsored by the Foundation of Technology
(ISBN-951-45-5116-2) Avail: NTIS HC A07/MF A01

The work deals with the basic computer algorithms and their application long range network planning. The full a.c. load flow is calculated for every network state. Estimation for losses in each network state is obtained by performing a voltage level optimization routine. It finds the generator voltages, tap changer position and shunt compensation connections such that the losses are minimized simple method based on direct search was selected due to the significant mount of shut compensation equipment in the Finnish network that make the variables discontinuous. Losses are linearlized and expressed as a function voltage magnitude only. Sensitivity matrix is used to calculated these voltage changes. The inherently great need of computer storage to store this matrix and the long time to prepare it were overcome by assuming that small reactive power changes do not disturb the active power balance. This small approximation causes an error that is smaller than 1% but gives the benefit that the sensitivity matrix can be factorized and stored in a similar way to the Jacobia matrix used in load flow calculation. The optimization method has been proved to be feasible and fast in relatively large networks. It is in daily practical use at a utility. Numerical examples demonstrate the effect of corona losses on the optimal voltage level. Author

**N82-14447*#** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**MODELING AND ANALYSIS OF POWER PROCESSING SYSTEMS (MAPPS). VOLUME 1: TECHNICAL REPORT Final Technical Report, Oct. 1977 - Aug. 1980**
F. C. Lee, S. Rahman, R. A. Carter, C. H. Wu, Yuang Yu (TRW Defense and Space Systems Group, Redondo Beach, Calif.), and R. Chang (TRW Defense and Space Systems Group, Redondo Beach, Calif.) Dec. 1980 335 p refs
(Contract NAS3-21051)
(NASA-CR-165538; TRW-32660-6001-RU-01) Avail: NTIS HC A15/MF A01 CSCL 09C

Computer aided design and analysis techniques were applied to power processing equipment. Topics covered include: (1) discrete time domain analysis of switching regulators for performance analysis; (2) design optimization of power converters using augmented Lagrangian penalty function technique; (3) investigation of current-injected multiloop controlled switching regulators; and (4) application of optimization for Navy VSTOL energy power system. The generation of the mathematical models and the development and application of computer aided design techniques to solve the different mathematical models are discussed. Recommendations are made for future work that would enhance the application of the computer aided design techniques for power processing systems. A.R.H.

**N82-14448#** Frequency and Time Systems, Inc., Beverly, Mass.
**EVALUATION OF THE PERFORMANCE CHARACTERISTICS OF BVA RESONATORS UNDER STATIC AND DYNAMIC CONDITIONS Final Technical Report, 9 Jan. 1980 - 8 Jan. 1981**
Donald A. Emmons Griffiss AFB, N.Y. RADC Aug. 1981 45 p refs
(Contract F19628-80-C-0037; AF Proj. LD06)
(AD-A105064; RADC-TR-81-70) Avail: NTIS HC A03/MF A01 CSCL 09/1

This report presents results on evaluation and development of precision oscillators utilizing a novel quartz frequency control element, the BVA resonator. Performance characteristics of the BVA were evaluated utilizing an ensemble of oscillators all having SC-cut BVA resonators. Important results include the demonstration of low g-sensitivity, reduced sensitivity to thermal stress, and very good frequency stability. The systematic dependence of aging rate on crystal drive level was investigated. A high precision BVA oscillator was delivered to the procuring agency. Throughout the program, technical coordination efforts have involved AFSC, DRET (France) and OSA (SW). Author (GRA)

**N82-14449#** TRW Defense and Space Systems Group, Redondo Beach, Calif.
**MONOLITHIC MICROWAVE PREAMPLIFIER Final Report, 1 Jul. 1979 - 31 Dec. 1980**
A. Benavides, R. Kaelberer, T. S. Lin, D. Romeo, and K. Weller Jul. 1981 182 p
(Contract N00014-77-C-0645; NR Proj. 251-028)
(AD-A104857; TRW-S/N-32153.000) Avail: NTIS HC A09/MF A01 CSCL 09/5

A GaAs monolithic microwave preamplifier has been fabricated and characterized. The design was implemented by a cascade connection of eight stages in a single ended configuration. The input, output and interstage matching sections utilized microelectronic siral rectangular inductors and MOM capacitors. The best unit yielded an average gain of 25 dB from 3 to 8 GHz. GRA

**N82-14450#** Varian Associates, Palo Alto, Calif.
**DISPENSER CATHODE PHYSICS Final Technical Report, 1 Aug. 1979 - 1 Nov. 1980**
Michael C. Green Griffiss AFB, N.Y. RADC Jul. 1981 87 p refs
(Contract F30602-79-C-0220; AF Proj. 4506)
(AD-A105126; RADC-TR-81-211) Avail: NTIS HC A05/MF A01 CSCL 09/1

The structure and composition of the emissive layers of activated and stabilize B-type and M-type cathode surfaces at operating temperature were investigated using X-ray photoelectron spectroscopy and high spatial resolution Auger Spectroscopy. The results indicate that the activating layer consists of a monolayer or submonolayer film of barium and oxygen of stoichiometry close to Ba1O1. The emissive layer was found to be vertically ordered, with barium concentrated in the first monolayer above oxygen. The primary difference observed between the B-type and M-type surfaces was increased coverage of the underlying metal by the barium/oxygen layer in the M-type case. The spectra of the emissive layer, although quite different from those of 'bulk' barium oxide, were consistent with a barium-oxygen bonding interaction. A theoretical model of the bonding of barium and oxygen to each other and to the underlying metal matrix

surface was proposed, consistent with the above experimental data and with the published results of other workers in the field. A calculation of the lattice stabilization energy in bulk ionic BaO indicated that the bonding in the emissive layer must be predominantly covalent. In Appendix A, a new user-oriented method of plotting cathode emission test data in the form of Miram-plots of normalized current density against temperature is described. Examples are given of the manner in which such plots clearly delineate changes in cathode performance capability with time and specific cathode failure modes. The cathode physics of a novel failure mode of a high current density cathode involving saturation of pore center emission is described. GRA

**N82-14451#** Army Materiel Development and Readiness Command, Adelphi, Md. Countermeasures/Countercountermeasures Office.

**SIGNAL PROCESSING THEORY OF BRAGG CELLS**

Don J. Torrieri May 1981 22 p refs

(DA Proj. 1S2-63749-D-462)

(AD-A100451; CM/CCM-81-1) Avail: NTIS HC A02/MF A01 CSCL 09/5

The acousto-optical interaction theory is used to develop a basic theory that explains the signal processing capabilities of Bragg cell devices. Examples of devices for frequency estimation, correlation, and Fourier transformation are presented. Author

**N82-14452#** Brigham Young Univ., Provo, Utah. Dept. of Chemical Engineering.

**LITHIUM-ALUMINUM ALLOY ELECTRODES IN LITHIUM CHLORATE**

David H. Shen and Douglas N. Bennion 20 Jan. 1981 21 p refs Submitted for publication Prepared in cooperation with California Univ., Los Angeles

(Contract N00014-80-C-0345; NR Proj. 359-551)

(AD-A105902; TR-2) Avail: NTIS HC A02/MF A01 CSCL 09/1

To prevent lithium dendrite growth during cycling of Li electrodes in molten LiClO3 at 140 C, a Li-Al electrode in cells of the type Li/LiClO3/LiAl has been investigated. Two discharge plateaus, one about 0.42V and the other about 0.20V versus a lithium wire, were obtained. No lithium dendrites were observed. Continued cycling caused the lithium-aluminum electrode to break down to particles or grains. The corrosion of isolated Al grains during operation of a Li-Al electrode was confirmed using atomic absorption spectrophotometer (AA) analysis on a white precipitate formed where the alloy electrode had been.

Author (GRA)

**N82-14453#** Michigan Univ., Ann Arbor. Electron Physics Lab.

**DESIGN, PERFORMANCE AND DEVICE/CIRCUIT LIMITATIONS OF N-WAY SYMMETRICAL IMPATT DIODE POWER COMBINING ARRAYS Interim Technical Report, Jul. 1979 - Feb. 1981**

D. F. Peterson and G. I. Haddad Wright-Patterson AFB, Ohio AFWAL Aug. 1981 90 p

(Contract F33615-77-C-1132; AF Proj. 2002)

(AD-A105663; TR-149; AFWAL-TR-81-1107) Avail: NTIS HC A05/MF A01 CSCL 09/5

Circuit design and stability criteria are developed for a new class of IMPATT diode power combiners. These combiners make use of radial-symmetric circuits and provide an optimal integration of device and circuit properties to perform the power adding function. Both lossless N-way combiners and resistively stabilized N-way combiners are considered. Examples of this combining technique are given at frequencies of 10 GHz and 90 GHz which make use of realistic IMPATT diode parameters. The 30-W, ten-diode lossless X-band combiner indicates a 1-dB locking bandwidth of 300 MHz and 10 dB gain, while the millimeter-wave combiner provides a 1-dB bandwidth of 9 GHz at 87 GHz and 10 dB locking gain. A 100-W, resistively stabilized 10 GHz, ten-diode combiner shows a 150 MHz locking bandwidth, also at 10 dB locking gain. Author (GRA)

**N82-14454#** Naval Research Lab., Washington, D. C. Combustion and Fuels Branch.

**GENERATION OF ELECTROSTATIC CHARGE IN FUEL HANDLING SYSTEMS: A LITERATURE SURVEY Final Report, 1973 - 1980**

J. T. Leonard 24 Sep. 1981 55 p refs

(AD-A106056; NRL-8484) Avail: NTIS HC A04/MF A01 CSCL 05/2

A review is presented on the status of research on the generation and dissipation of electrostatic charge by hydrocarbon liquids and fuels, with emphasis on the period 1973-1980. Both metallic and nonmetallic fuel handling systems are covered, including the special problems encountered in aircraft fuel tanks filled with polyurethane foam. The review stresses recent advances and presents opportunities for future research in some neglected, but nonetheless fundamentals areas affecting the charge generation process. Author (GRA)

**N82-14455#** Naval Research Lab., Washington, D. C.

**PROCEEDINGS OF THE MOLECULAR ELECTRONIC DEVICES WORKSHOP Final Report**

Forrest L. Carter, ed. 22 Oct. 1981 399 p refs Proceedings of Conf. held at Washington, D.C., 23-24 Mar. 1981

(Contract N00014-81-WR-10052)

(AD-A105816; NRL-MR-4662) Avail: NTIS HC A17/MF A01 CSCL 09/1

Switching at the molecular level is discussed in several papers. The Bell Laboratories' workers developed the concept of 'smart molecules' where eight bit data processing could be carried out via optical methods. F. L. Carter's discussion of both conformational switching and electron tunnelling at the molecular level envisions either soliton propagation in conjugated linear polymers or metal-like conduction in (SN)x as modes of communication with the switching elements. An experimental example of fast switching in thin films of CuTCNQ is provided. The section on materials and microfabrication includes D. Sandman's (GTE) generalized approach to organic pi-donor-acceptor systems and K. Ulmer's (Genex) speculation on the engineered biological assembly of molecular ultracircuits. The first step toward the biological assembly of an electronic device is discussed in two related papers in which Ag metal was selectively deposited on a polylysine substrate. Two serious problem areas that might be anticipated are considered by D. K. Ferry (quantum effects in arrays of devices) and C. S. Guenzer ('soft' errors). That nature has, of course, numerous practical examples of 'molecular' switching which is evident from, among others, the two stimulating papers of L. L. Shipman (ANL) on the photosynthesis process and from a paper of S. R. Hameroff and R. Watts (U. of Arizona) on microtubules. They developed a micro-computer model of the ubiquitous microtubules that strongly suggests that considerable information processing occurs in the alpha, beta tubulin helical structure. GRA

**N82-14456#** Texas Instruments, Inc., Dallas. Central Research Lab.

**DEVELOPMENT OF FABRICATION TECHNOLOGY FOR THE PERMEABLE BASE TRANSISTOR Annual Report, 1 Feb. 1980 - 31 Mar. 1981**

W. R. Frensley and G. H. Westphal 1 Sep. 1981 33 p

(Contract N00014-80-C-0246)

(AD-A105532) Avail: NTIS HC A03/MF A01 CSCL 09/1

Efforts during the first year of this contract have concentrated on the development of the key processes required for fabrication of the permeable base transistor: sub-micrometer lithography and epitaxial overgrowth. Electron beam lithography was used, with a dry-process resist and ion milling, to produce 0.25 micrometer lines. The arsenic trichloride epitaxial process was used to embed metal structures in a single crystal of gallium arsenide. High-resolution electron microscopy revealed that the epitaxial overgrowth was imperfect, leaving voids in the single crystal which are often too small to be resolved using conventional electron microscopy. GRA

**N82-14457#** Western Research Corp., San Diego, Calif.

**THE TRANSVERSE RF ACCELERATOR Final Technical Report, 15 Aug. 1980. - 15 Feb. 1981**

Nino R. Pereira 11 Sep. 1981 93 p refs

(Contract N00014-80-C-0902; DARPA Order 3747)

(AD-A105896; WRC-R-308) Avail: NTIS HC A05/MF A01 CSCL 20/7

High electric fields are obviously advantageous in powerful electron accelerators: for a given energy gain per particle, the

device length is inversely proportional to the maximum field; and the maximum current is roughly proportional to the field. The transverse RF accelerator provides a high field strength by using an accelerator cavity analogous to an optical resonator: the focussing of electromagnetic energy produces large fields along the cavity axis for manageable fields at the wall. In addition, it is possible to have the fields largely transverse, permitting very high accelerating gradients. This report discusses two basic topics: the field structure as related to the acceleration mechanism, and limitation on the electric field strength. GRA

**N82-14458#** Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
**MEANING OF THE NEGATIVE IMPEDANCE**
G. Conciauro (Inst. di Elettronica dell'Universita' di Pavia) and M. Puglisi Jun. 1981 7 p
(Contract DE-AC02-76CH-00016)
(DE81-030830; BNL-51420) Avail: NTIS HC A02/MF A01

It is shown that the negative real part of an input impedance does not mean instability of the related circuit. A negative real part of the input impedance means only that the concerned circuit is active. DOE

**N82-14459#** Bendix Corp., Kansas City, Mo.
**CHARACTERIZATION AND COMPARISON OF THERMISTOR THICK FILMS**
R. W. Gehman Sep. 1981 56 p refs
(Contract DE-AC04-76DP-00613)
(DE82-000831; BDX-613--2683) Avail: NTIS HC A04/MF A01

Four film inks were evaluated for HMC production use. The physical, chemical and electrical properties of the wet inks and fired films were measured. Variations in the physical and chemical properties of the inks were used to explain variations in thermistor electrical resistance and temperature coefficient of resistance. DOE

**N82-14460#** Oak Ridge National Lab., Tenn.
**PERFORMANCE OF AN INTERNALLY COOLED SUPERCONDUCTING SOLENOID**
J. W. Lue and J. R. Miller 1981 8 p refs Presented at the 1981 Cryogenic Eng. Conf., San Diego, Calif., 10 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028058; CONF-810835-13) Avail: NTIS HC A02/MF A01

A superconducting magnet constructed of an internally cooled solenoid was produced and tested. Particular emphasis was placed on measurement of the stability margins of the magnet. Test results showed that: (1) this magnet reached short sample critical current limit with no training; (2) no degradation due to strand motion in fields was apparent; (3) it can be charged and discharged to high current densities and high fields at a fast rate; (4) it has reasonable stability margin up to 90% of the critical current; (5) stability measurements verify the scaling relationship for a limiting current below which there is single valued high stability margin; (6) it is not really necessary to have bulk helium flow to ensure high stability; and (7) very high pulse field changes can be accomodated as long as the energy deposition is within its stability margin. DOE

**N82-14461#** California Univ., Berkeley. Lawrence Berkeley Lab.
**CRYOGENIC TESTS OF GLASS-EPOXY BASED ELECTRICAL INSULATION**
J. D. Taylor, P. S. Martin (Fermi National Accelerator Lab., Batavia, Ill.), M. Pripstein, and M. A. Green Aug. 1981 10 p refs Presented at the 1981 Cryogenic Eng. Conf., San Diego, Calif., 10 Aug. 1981
(Contract W-7405-eng-48)
(DE81-028144; LBL-12782; CONF-810835-11) Avail: NTIS HC A02/MF A01

A thin superconducting solenoid for the Time Projection Chamber (TPC) experiment was constructed and tested. A failure of the ground plane insulation damaged the coil to the point that it required rebuilding. An extensive study of this failure indicated that an iron chip embedded in the bore tube had penetrated the insulation. Before rebuilding the coil, an investigation of the insulation system was done with the goal of determining the most reliable techniques and materials for withstanding high voltages in the coil package. The experience with the TPC coil and its prototypes indicate that glass cloth vacuum-impregnated with epoxy is an excellent material for cryogenic applications from the mechanical standpoint. The investigation concentrated on different types of glass cloth and on composites containing glass cloth. DOE

**N82-14462#** Battelle Pacific Northwest Labs., Richland, Wash.
**EDDY-CURRENT PHASOGRAPHY**
H. D. Collins, T. J. Davis, L. J. Busse, and R. P. Gribble 1981 19 p refs Presented at the 13th Symp. on Nondestructive Evaluation, San Antonio, 21 Apr. 1981
(Contract DE-AC06-76RL-01830)
(DE81-024242; PNL-SA-9499; CONF-810470-2) Avail: NTIS HC A02/MF A01

Phasography shows excellent potential for high resolution imaging of flaws using eddy current data. The process is an eddy current equivalent to acoustic holography. Phase multiplication of the detected coherent signal is used to simulate a test wavelength one to two orders of magnitude smaller than the actual wavelength, permitting the use of image reconstruction techniques. Since this process is performed on the detected data, the eddy current penetration depth remains unchanged. It is also possible to apply this phase multiplication technique to low frequency acoustic holography, resulting in a test which combines excellent penetration of difficult materials with high resolution images. Preliminary experimental results graphically illustrate this unique imaging technique. Eddy current phasograms and their reconstructed images of small internal simulated defects in 1 mm thick stainless steel plates are presented. DOE

**N82-14463#** Siemens A.G., Munich (West Germany). Werk fuer Integrierte Schaltungen.
**INTEGRATED CIRCUITS FOR INDUSTRIAL CONTROLLER APPLICATIONS Final Report**
Theo Freitag, Gerhard Gehring, Gerhard Weil, and Wolfgang Werner Bonn Bundesministerium fuer Forschung und Technologie Nov. 1980 44 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-116; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsrhue, West Germany DM 9,30

A family of drivers, sensors, and a bitprocessor were developed in order to obtain simple, cheap and flexible industrial control systems. Work on the bit processor was stopped at the layout stage. The process for LSTTL (Large Scale Transistor-Transistor Logic) integrated circuits was completely developed. Chip and assembly development of an integrated optical sensor is described. Author (ESA)

**N82-14464#** Zeiss (Carl), Oberkochen (West Germany).
**ELECTRONIC IMAGE ANALYSIS Final Report**
Josef Gahm, Rudolf Grosskopf, Hubert Jaeger, and Franz Trautwein Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 50 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-126; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsrhue, West Germany DM 10,50

An electronic system for image analysis was developed on the basis of low and medium cost integrated circuits. The printed circuit boards were designed, using the principles of modern digital electronics and data processing. The system consists of modules for automatic, semiautomatic and visual image analysis. They can be used for microscopical and macroscopical observations. Photographs can be evaluated, too. The automatic version is controlled by software modules adapted to various applications. The result is a system for image analysis suitable for many different measurement problems. The features contained in large image areas can be measured. For automatic routine analysis controlled by processing calculators the necessary software and hardware modules are available. Author (ESA)

**N82-14465#** AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereich Halbleiter.
**MOS FIELD EFFECT TRANSISTORS FOR UHF APPLICA-**

**TIONS Final Report**
Wilfried Quast and Winfried-Johann Rabe Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 111 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-030; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 23,30

Three different techniques for the fabrication of UHF MOSFET's were developed and their suitability as a production process was examined. The source and drain regions were realized by phosphorus ion implantation followed by selective oxidation, by diffusion from P and As doped oxides (PDO), and by a double lateral diffusion process. In order to characterize the fabricated MOSFET tetrodes, S parameters at high frequencies (800 MHZ) were measured. The best results were obtained with elements which were manufactured using the PDO technique. A one-dimensional small signal MOS model was derived which is able to describe the static characteristics of short channel MOS transistors. Author (ESA)

**N82-14466#** AEG-Telefunken, Ulm (West Germany). Geschaeftsbereich Roehren und Baugruppen.
**DEVELOPMENT OF A DUAL MODE SATELLITE TRAVELING WAVE TUBE 11GHz, 12W/6W Final Report, Jul. 1978**
Lieter Deml Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 94 p refs Partly in GERMAN and ENGLISH Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-001; ISSN-0170-1339) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 19,80

A high power 11GHz dual mode traveling wave tube (TWT) was developed for use in communication satellites. The tube is based on the technology of previous space-qualified tubes (TL12006, TL12022, and TL12025). The tube operates at 12 or 6W, separated by 3dB, without a dramatic efficiency loss in the low power mode. Gain, efficiency and nonlinear distortion criteria are all met, by channel tuning the tube within the operating band (from 10.9 to 11.8 GHz). The channel bandwidth is 100MHz. Author (ESA)

**N82-14467#** Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
**LOW POWER HYBRID CIRCUITS FOR SATELLITE-BORNE TIME OF FLIGHT SPECTROMETERS Final Report, Oct. 1980**
Berend Wilken and Werner Weiss Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-013; MPAE-T-74-80-25; ISSN-0170-1339) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 6,70

A charge sensitive amplifier and an input discriminator for a time amplitude converter were developed for time of flight spectrometers, and tested as thin film hybrids. Time of flight spectrometers are very important tools for analyzing the ion composition of planetary and interplanetary magnetized plasma populations. The particle mass is obtained from simultaneous measurements of the particle energy and velocity. Application of this technique in satellite instruments requires low mass and low power circuits. The amplifier weighs 1.9 g and has a power consumption of 6.8 mW. The hybrid weighs 2.9 g with 100 mW power. The time walk is smaller than 200 psec over a dynamic range of more than 30. Author (ESA)

**N82-14468#** Oxford Univ. (England). Dept. of Engineering Science.
**OPTIMUM DESIGN OF WIDE-BANDWIDTH, LOW-NOISE PHOTODIODE AMPLIFIERS. VOLUME 1: BANDWIDTH**
D. K. Hamilton 1981 14 p refs
(OUEL-1363/81-Vol-1) Avail: NTIS HC A02/MF A01

A circuit with video applications was tested. A reversed biased junction is a parallel combination of resistance and capacitance, which varies with the applied reverse voltage. The complete equivalent circuit model includes these components in parallel with a current generator. For optimum response at high frequency critical damping is necessary. The circuit allows the use of an amplifier with a wider open loop bandwidth than one compensated for unity gain, with a corresponding increase in system bandwidth. Author (ESA)

**N82-14469#** Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
**EVALUATION OF FRENCH HYBRID MICROELECTRONICS [EVALUATION DE LA MICROELECTRONIQUE HYBRIDE FRANCAISE]**
Marc Billot Oct. 1980 15 p In FRENCH; ENGLISH summary (CNES-NT-97) Avail: NTIS HC A02/MF A01

Thin and/or thick film technology of French manufacturers of hybrid circuits is assessed. Hybrid devices were subjected to mechanical and environmental life tests, and failure analysis was performed. Results show that both thick and thin deposition layers have good stability characteristics. The only significant difference is that thin films age better than thick films over the long-term at high temperature. Reproducibility of results for active components in the form of chips is poor when tested before they are incorporated into hybrid circuits. The principal cause of failure is identified as faulty interconnections for thick film active components. Author (ESA)

**N82-14470#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**MODELING THE INFLUENCE OF STATIC ACCELERATION ON SURFACE WAVE (QUARTZ) OSCILLATORS Ph.D. Thesis - Paris Univ.**
Patrick Levesque 1981 96 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-726)
(ONERA-NT-1981-3; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

The application of a static acceleration on a quartz oscillator, working in elastic surface wave mode, was modeled. Modification of the wave propagation speed through the substrate and its frequency are studied. The frequency shift depends on the nature of the substrate through which the wave is propagated, but also on its dimensions and its mode of attachment. The relationship between the stresses arising in the substrate during the acceleration and the sensitivity to this acceleration of surface wave devices are shown. Author (ESA)

**N82-14471#** Engins Matra, Velizy (France). Lab. Connection Reseaux.
**STUDY OF AN AUTOADAPTIVE EQUALIZER: COMPUTERIZED SIMULATION BASED ON KALMAN FILTER OR GRADIENT METHODS [ETUDE D'UN EGALISEUR AUTOADAPTATIF, PAR SIMULATION SUR ORDINATEUR, EN UTILISANT LES METHODES DE FILTRAGE DE KALMAN OU DE GRADIENT]**
Bruno Arbaud 1981 62 p refs In FRENCH
(TEL/ARB/81) Avail: NTIS HC A04/MF A01

The principle of an autoadaptive equalizer is envisaged, specifically to deal with parasitic noise on data transmission lines. Data transmission is described and the necessity of an equalizer is shown. The appropriate mathematical tools are layed out and computerized simulation, along with results obtained, are explained. Programs that make use of Kalman numerical filtering are presented. Author (ESA)

# 34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

**N82-14472#** Technische Univ., Berlin (West Germany).
**EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF THE CASING GEOMETRY UPON THE FLOW CONDITIONS AND THE NOISE OF A CENTRIFUGAL FAN Ph.D. Thesis**
Teofani Gikadi 1981 136 p refs In GERMAN Prepared in

cooperation with DFVLR, Berlin
(DFVLR-FB-81-20) Avail: NTIS HC A07/MF A01

Beginning with a casingless impeller with six backward curved blades, the influence of a small logarithmic volute casing with a cutoff clearance of delta/R = 0.014 (R = impeller radius) upon the flow through the rotating impeller ducts is studied. There was a blockage of the flow in each impeller duct when passing the cutoff, due to the small cutoff clearance. An optimization of the casing geometry regarding low noise and high fan efficiency leads to a logarithmic spiral with a large cutoff clearance of detla/R = 0.3. The noise is reduced by 22 dB (A) without loss in fan efficiency. S.L.

**N82-14473*#** Cambridge Hydrodynamics, Inc., Mass.
**NUMERICAL STUDIES OF LAMINAR AND TURBULENT DRAG REDUCTION Final Report**
R. Balasubramanian and S. A. Orszag Washington NASA Dec. 1981 33 p refs
(Contract NAS1-16237)
(NASA-CR-3498; CHI-57) Avail: NTIS HC A03/MF A01 CSCL 20D

Two-dimensional incompressible flow over wavy surfaces is studied numerically by spectral methods. Turbulence effects are modeled. Results for symmetric and asymmetric wave forms are presented. Effect of propagating surface waves on drag reduction is studied. Comparisons between computer simulations and experimental results are made. Author

**N82-14474*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**COMPARISON OF THIN-FILM RESISTANCE HEAT-TRANSFER GAGES WITH THIN-SKIN TRANSIENT CALORIMETER GAGES IN CONVENTIONAL HYPERSONIC WIND TUNNELS**
Charles G. Miller, III Dec. 1981 93 p refs
(NASA-TM-83197; L-14627) Avail: NTIS HC A05/MF A01 CSCL 20D

Thin film gages deposited at the stagnation region of small (8.1-mm-diameter) hemispheres and gages mounted flush with the surface of a sharp-leading-edge flat plate were tested in the Langley continuous-flow hypersonic tunnel and in the Langley hypersonic CF4 tunnel. Two substrate materials were tested, quartz and a machinable glass-ceramic. Small hemispheres were also tested utilizing the thin-skin transient calorimeter technique usually employed in conventional tunnels. One transient calorimeter model was a thin shell of stainless steel, and the other was a thin-skin insert of stainless steel mounted into a hemisphere fabricated from a machinable-glass-ceramic. Measured heat-transfer rates from the various hemispheres were compared with one another and with predicted rates. The results demonstrate the feasibility and advantages of using-film resistance heat-transfer gages in conventional hypersonic wind tunnels over a wide range of conditions. A.R.H.

**N82-14475*#** National Aeronautics and Space Administration, Washington, D. C.
**DETERMINATION OF THE TRANSITION POINT IN A BOUNDARY LAYER BY THE MEASUREMENT OF PRESSURE FLUCTUATION**
Vaclav Strach Dec. 1981 14 p refs Transl. into ENGLISH from Zpravodaj VZLU (Poland), no. 5, 1980 p 201-205 Original language document was announced as A81-31040 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3542)
(NASA-TM-76639) Avail: NTIS HC A02/MF A01 CSCL 20D

A method is developed for determining the laminar-to-turbulent transition point in a boundary layer. The method involves the measurement of pressure on the surface of the body and the computation of pressure fluctuations. This method of determining the transition point is suitable when visualization methods cannot be used. Author

**N82-14476*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**NUMERICAL STABILITY OF AN EXPLICIT FINITE DIFFERENCE SCHEME FOR THE SOLUTION OF TRANSIENT CONDUCTION IN COMPOSITE MEDIA**
Warren Campbell Nov. 1981 29 p refs
(NASA-TM-82453) Avail: NTIS HC A03/MF A01 CSCL 20D

A theoretical evaluation of the stability of an explicit finite difference solution of the transient temperature field in a composite medium is presented. The grid points of the field are assumed uniformly spaced, and media interfaces are either vertical or horizontal and pass through grid points. In addition, perfect contact between different media (infinite interfacial conductance) is assumed. A finite difference form of the conduction equation is not valid at media interfaces; therefore, heat balance forms are derived. These equations were subjected to stability analysis, and a computer graphics code was developed that permitted determination of a maximum time step for a given grid spacing. Author

**N82-14477#** Physical Research, Inc., Palos Verdes Estates, Calif.
**HIGH REYNOLDS NUMBER CYLINDER FLOW WORKSHOP Final Report**
W. C. L. Shih 17 Aug. 1981 98 p refs Workshop held at Moffett Field, Calif., 27-28 Nov. 1979 Sponsored by Science Applications, Inc.
(Contract N00014-79-C-0893)
(AD-A105088; PRI-LA-81-R003) Avail: NTIS HC A05/MF A01 CSCL 20/4

The purpose of this workshop was to review the state of knowledge of high Reynolds number (incompressible) rigid cylinder flows, to identify problem areas, and recommend research for understanding these flow conditions. The recommendations are being incorporated into the design of a comprehensive experiment that is scheduled for Spring of 1982 in the NASA Ames Research Center 12-foot pressurized wind tunnel. GRA

**N82-14478#** Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mechanical and Aerospace Engineering.
**A FLOW-VISUALIZATION STUDY OF TURBULENT SPOTS ON SOLID AND COMPLIANT SURFACES Final Report, 1 Jan. - 30 Sep. 1981**
J. W. Hoyt Oct. 1981 10 p refs
(Contract N00014-81-K-0290; ONR Proj. 062-689)
(AD-A106073) Avail: NTIS HC A02/MF A01 CSCL 20/4

A water table study of the formation of turbulent (spots) in laminar flow shows no difference in the production, appearance or other characteristics of spots flowing over either rigid or compliant surfaces. An indication of damping was obtained with compliant surfaces at very low Reynolds numbers. Author

**N82-14479#** Army Armament Research and Development Command, Dover, N. J.
**SHOCK FRONT RISE TIME IN WATER Program Status Report**
Paul Harris and Henri-Noel Presles (Univ. of Poitiers, France) Oct. 1981 30 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A105704; AD-E400719; ARLCD-TR-81032) Avail: NTIS HC A03/MF A01 CSCL 20/11

A review is made of the present status of the experimental-theoretical program for the evaluation of the shock front thickness in water, and the results of recently performed hyperbolic tangent shock front structure calculations are presented. The hyperbolic tangent results, when compared with experimental data, predict a shock front thickness upper limit of 6.2 X 10 to the minus 6th power cm at 5.8 kbar. Experiments and theory planned for the near future are outlined. These experiments will involve shock front optical reflectivity and shock polarization voltage measurements. Some preliminary theory corresponding to these planned experiments is presented. In particular, a net electric dipole alignment calculation is presented which predicts approximately 5 mv across a 50-ohm load at 15 kbars. The anomalously large Soviet shock viscosity results are considered (without resolution of the question), and the possibility of significant hydrogen bond breaking at shock pressures above 5.8 kbars is discussed. GRA

**N82-14480#** Naval Research Lab., Washington, D. C.
**A CLASS OF MONOTONIC SHOCK-CAPTURING DIFFERENCE SCHEMES**
A. I. Zhmakin (Academy of Sciences (USSR), Leningrad) and A. A. Fursenko (Academy of Sciences (USSR), Leningrad) 30 Jul.

1981 48 p refs Sponsored in part by Defense Nuclear Agency
(AD-A105601; NRL-MR-4567) Avail: NTIS HC A03/MF A01 CSCL 20/4

Two principal approaches used in the numerical study of unsteady inviscid compressible flow problems -- shock-fitting and shock-capturing -- are discussed briefly. This paper presents a new example of the latter approach. The proposed method is monotonic and provides second-order accuracy in regions where the concept of order is meaningful. The method is simple and fast running. The monotonicity of a standard finite difference scheme (the well-known MacCormack scheme was chosen in the paper) is achieved by means of a local conservative smoothing operation. It eliminated nonphysical ripples, which usually appear near discontinuities when nonmonotonic schemes are used. The method is similar to one developed by Boris and Book and gives essentially the same results, but is much simpler and faster. The proposed method is compared to some other finite difference schemes. Two one dimensional tests are used: a linear convection equation and a shock tube problem. Finally, the example of nonsteady three-dimensional scattering of a shock wave by a step obstacle of finite width is discussed. GRA

**N82-14481#** Naval Postgraduate School, Monterey, Calif.
**COMPARISON OF VISCOUS AND PRESSURE ENERGY EXCHANGE IN FLUID FLOW INDUCTION M.S. Thesis**
Harry Joseph Rucker, Jr. Jun. 1981 72 p refs
(AD-A105808) Avail: NTIS HC A04/MF A01 CSCL 20/4

The pumping power and efficiency of a jet pump can be substantially increased by introducing a rotating primary flow. The rotating primary causes an energy transfer from the primary fluid to the secondary fluid through a pressure force. Non-rotating jet pumps transfer energy through viscous friction. The reversible nature of the work accomplished through a pressure exchange is inherently more efficient than the nonreversible work accomplished through viscous interaction. This study focuses on the interaction zone of the inducer and specifically on an experimental comparison of viscous and pressure energy exchange. GRA

**N82-14482#** Naval Surface Weapons Center, White Oak, Md. Strategic Systems Dept.
**HEAT-TRANSFER AND PRESSURE TESTS ON AN OBLATE ELLIPTIC NOSETIP IN THE NSWC/WO HYPERSONIC TUNNEL AT MACH NUMBER 5 (STR-1346)**
M. D. Jobe Jun. 1981 60 p refs
(AD-A106058; NSWC/MP-81-259) Avail: NTIS HC A04/MF A01 CSCL 20/13

An extensive data base on a 2:1 elliptical nosetip shape to be utilized for verification of the AVCO MTSCT three dimensional transition code was generated in the NSWC Hypersonic Tunnel at Mach Number 5. Four nosetip models in which the surface roughness was varied from a smooth wall to a roughness value of 10 mils were tested. The first three nosetips were instrumented with 112 backfaced chromel-alumel thermocouples. The fourth model (i.e., 10-mil roughness) instrumentation consisted of 67 thermocouples and 31 Statham pressure transducers. The test matrix consisted of sixty runs where the variables included angle-of-attack, tunnel Reynolds number, and wall enthalpy ratio. Author (GRA)

**N82-14483#** TRW, Inc., Redondo Beach, Calif.
**COMPRESSIBLE FLUIDS INVESTIGATION Final Report**
C. Gustavson and Robert Dombroski Oct. 1981 54 p refs
(Contract DAAK10-80-C-0257)
(AD-A105703; AD-E400704; ARLCD-CR-81034) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report describes an investigation of compressible fluids for use in artillery recoil mechanisms. An examination of chemical theory revealed the ideal properties which a compressible fluid should possess. More than 20 sample fluids were evaluated in a series of hydrostatic and miscibility tests. Results indicate that perfluorinated compounds exhibit better qualities for artillery applications than the silicone oil currently in use. GRA

**N82-14484#** Los Alamos Scientific Lab., N. Mex.
**COOL-DOWN FLOW-RATE LIMITS IMPOSED BY THERMAL STRESSES IN LNG PIPELINES**
J. K. Novak, F. J. Edeskuty, and J. R. Bartlit 1981 8 p refs Presented at the Cryogenic Eng. Conf., San Diego, Calif., 10-14 Aug. 1981
(Contract W-7405-eng-36)
(DE81-028731; LA-UR-81-2365; CONF-810835-4) Avail: NTIS HC A02/MF A01

Warm cryogenic pipelines are usually cooled to operating temperature by a small, steady flow of the liquid cryogen. If this flow rate is too high or too low, undesirable stresses will be produced. Low flow-rate limits based on avoidance of stratified two-phase flow were calculated for pipelines cooled with liquid hydrogen or nitrogen. High flow-rate limits for stainless steel and aluminum pipelines cooled by liquid hydrogen or nitrogen were determined by calculating thermal stress in thick components vs flow rate and then selecting some reasonable stress limits. The present work extends these calculations to pipelines made of AISI 304 stainless steel, 6061 aluminum, or ASTM A420 9% nickel steel cooled by liquid methane or a typical natural gas. Results indicate that aluminum and 9% nickel steel components can tolerate very high cool-down flow rates, based on not exceeding the material yield strength. DOE

**N82-14485#** California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
**EFFECTS OF SUSPENDED PARTICLES ON THE RATE OF MASS TRANSFER TO A ROTATING DISK ELECTRODE M.S. Thesis**
David Jeffries Roha Jun. 1981 310 p refs
(Contract W-7405-eng-26)
(DE81-028002; LBL-12737) Avail: NTIS HC A14/MF A01

Limiting currents for the reduction of ferric cyanide at a rotating disk were determined in the presence of 0 to 40 percent by volume of spherical glass beads. Experiments were conducted with six different particle diameters, and with rotation speeds in the range of 387 to 270 rpm, using both a 0.56 cm and a 1.41 cm radius disk electrode. Two mass transfer models, both of which assume that the beads are in contact with the disk electrode and moving parallel to its surface, are offered. In the surface renewal model it is assumed that complete mixing takes place with the passage of each bead and the boundary layer is replaced with fresh bulk solution. While with the particle film model it is assumed the bead and a clinging film of fluid rotate together. The film promotes mass transfer by alternately absorbing and desorbing the diffusion species. The particle film model best explains the observed behavior of the limiting current density. DOE

**N82-14486#** California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Mechanical Engineering.
**GENERALIZED ALGEBRAIC RELATION FOR PREDICTING DEVELOPING CURVED CHANNEL FLOW WITH A k-EPSILON MODEL OF TURBULENCE**
Joseph A. C. Humphrey and Farzad Pourahmadi Jun. 1981 16 p refs Presented at 3rd Symp. on Turbulent Shear Flow, Davis, Calif., 9-11 Sep. 1981
(Contract W-7405-eng-48)
(DE81-028131; LBL-12009-Rev) Avail: NTIS HC A02/MF A01

Using algebraic approximations for the Reynolds stress equations a general expression was derived which accounts simultaneously for the effects of streamline curvature and pressure strain in the flow, including wall induced influences on the velocity fluctuations. The expression derived can be shown to encompass similar but more specific formulations proposed by Bradshaw, Rodi, and Leschziner and Rodi. The present formulation was used in conjunction with a k-e model of turbulence to predict developing, two dimensional, curved channel flows where both curvature and pressure strain effects can be large. Minor modifications to include the influence of curvature on the length scale of the flow near the walls produce a significant improvement in the calculations. While, in general, predictions, are in good agreement with experimental measurements of mildly and strongly curved flows, the model tends to overpredict the kinetic energy of turbulence in the inner radius (convex) wall region. DOE

**N82-14487#** Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
**THE TEMPERATURE STRUCTURE OF A TURBULENT**

**VORTEX RING [DIE WAERMESTRUKTUR EINES TURBULENTEN RINGWIRBELS]**
Peter E. M. Schneider Mar. 1980 35 p refs In GERMAN (MPIS-4/1980: ISSN-0436-1199) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10,05

Temperature profiles in turbulent vortex rings were experimentally investigated. A test arrangement was used that produces vortices which are visualized by coloring and Schlieren-photography. Temperature profiles were obtained by a hot-film anemometer. Turbulent vortex rings are structures with individual temperature profiles whose temperature is everywhere higher than that of the surrounding medium in test. Temperature measurements show that secondary vortices consist of core material, material from the transition region between vortex core and envelope, and material from the envelope.
Author (ESA)

**N82-14488#** Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
**TRANSFORMATION AND REFLECTION OF VORTEX RINGS IMPINGING ON A PLATE INCLINED WITH RESPECT TO THEIR TRANSLATION DIRECTION [UMBILDUNG UND REFLEXION EINES RINGWIRBELS AN EINER PLATTE, DIE SCHRAEG ZU SEINER TRANSLATIONSRICHTUNG ORIENTIERT IST]**
Peter E. M. Schneider Jul. 1980 101 p refs In GERMAN (MPIS-12/1980: ISSN-0436-1199) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 22,05

Reflection processes in turbulent boundary layers were investigated by examining the reflection angle of a vortex ring. The tests were conducted in a vortex generating setup. The vortices were colored and photographed. The primary vortex transforms into an oscillating vortex ring, while secondary vortices develop in its envelope. Reverse flow vortex rings, helix and double-helix vortices develop in its core. The reflection angle at which this new vortex leaves the plate is independent of the distance between the plate and the test stand inlet nozzle where the vortex ring is formed, the flow stability condition (laminar, ondulated, turbulent) of the vortex ring when it arrives at the plate, and the vortex ring translation velocity. Author (ESA)

**N82-14489#** Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
**EXPERIMENTAL INVESTIGATION OF INSTABILITY PHASES OF A LAMINAR VORTEX RING, IN LIGHT OF COMPARABLE INSTABILITY EVENTS IN TURBULENT SHEAR LAYER, BOUNDARY LAYER, AND CHANNEL FLOWS [EXPERIMENTELLE UNTERSUCHUNG DER INSTABILITAETSPHASEN EINES LAMINAREN RINGWIRBELS MIT HINBLICK AUF VERGLEICHBARE INSTABILITAETSEREIGNISSE IN TURBULENTEN SCHERSCHICHT-, GRENZSCHICHT- UND KANALSTROEMUNGEN]**
Peter E. M. Schneider Oct. 1980 99 p refs In GERMAN (MPIS-17/1980: ISSN-0436-1199) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 27,30

The laminar flow in a vortex is primarily determined by the toroidal laminar vortex core, the ondulatory flow by the ondulated laminar core, and the turbulent flow by the turbulent oscillating core. Inside these three global vortex flows, locally or globally unstable secondary vortices, and helix and double-helix flows are formed. A turbulence model was established in which turbulent flows consist of a complex organized vortex hierarchy and develop from an invarying degree, rhythmic sequence of unstable, laminar vortices as a result of an evolutional process. Author (ESA)

**N82-14490#** Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
**EXPERIMENTAL INVESTIGATION OF THE FLOW IN A ROTATING CIRCULAR CHANNEL Thesis [EXPERIMENTELLE UNTERSUCHUNG UEBER EINE STROEMUNG IN EINEM ROTIERENDEN RINGKANAL]**
Johannes Kuehl Nov. 1980 101 p refs In GERMAN (MPIS-21/1980: ISSN-0436-1199) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20,85

Mixing devices were studied using flow in a rotating cylindrical annulus with rectangular cross section, in which the medium has a free surface directed towards the rotation axis. The flow is considered as quasi-stationary. The flow is controlled by the equilibrium between pressure gradient and Coriolis force. There exists a frictionless central flow with mainly azimuthal velocity, two Ekman boundary layers perpendicular to the axis, and a boundary outer layer which becomes unstable at higher speeds. In the experiment, the flow was visualized in a stroboscopically illuminated rotating plexiglass channel by coloring. The approximate calculations were checked by means of velocity measurements. The expected Taylor-Gortler vortex was observed.
Author (ESA)

**N82-14393#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**SUBSONIC FLOW IN A CORNER**
Daniel Arnal and Jean Cousteix *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 45-62 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

# 35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

**N82-14491** Royal Aircraft Establishment, Farnborough (England).
**APPLICATIONS OF THE MICROSCAN 9 MICROANALYSER**
P. D. Pitcher Jan. 1981 19 p
(RAE-TM-MAT-358; BR77779) Copyright. Avail: Issuing Activity

A computer controlled electron probe microanalyzer used to obtain data on the chemical composition of areas down to 1 micron, is assessed. The X-rays generated by an electron beam incident on a specimen are analyzed by detection and counting, using energy dispersive and wavelength dispersive techniques. Qualitative, or quantitative analyses can be done of segregation, diffusion of particular elements, inclusion identification, contamination, etc. Results are obtained as uncorrected concentrations, Bragg angle, backgrounds and standard deviations. Author (ESA)

**N82-14492*#** Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Materials and Technology Lab.
**A PRELIMINARY DESIGN OF THE CRYOGENIC SYSTEM FOR THE COOLED LIMB SCANNING INTERFEROMETER RADIOMETER (CLIR), PHASE 3 Final Report**
L. G. Naes, R. T. Parmley, and T. C. Nast [1981] 82 p refs (Contract NAS5-26042)
(NASA-CR-166722; LMSC-D767447; TP-5848)
HC A05/MF A01 CSCL 14B

The performance of the cryogenic cooling system for the limb scanning interferometer radiometer (CLIR) instrument which was proposed to be flown on the Atmospheric-Magnetospheric Physics Satellite is discussed. The use of both normal boiling point liquid helium or hydrogen is considered. In determining the performance of the two cooler configurations, a nominal aperture heat of 4.33 watts was used, which is half the value used in previous studies. The reduced aperture heat load reflects that benefits achieved by using an improved baffle configuration. The ground support equipment necessary to support the CLIR cooler in either the liquid helium or solid hydrogen mode was determined. A parts list was generated for both the ground support equipment and the cooler system. R.J.F.

**N82-14493#** Technische Hogeschool, Delft (Netherlands).
**SILICON DEW-POINT SENSOR FOR ACCURATE HUMIDITY MEASUREMENT SYSTEMS Ph.D. Thesis**
Paulus Petrus Leonardus Restien Delf Univ. Press 10 Jun. 1981 157 p refs In ENGLISH; DUTCH abstract
Avail: NTIS HC A08/MF A01

The design and properties of an electronic humidity measuring system for the determination of the water-vapor content in air or other gases are described. The system is based on an integrated silicon dew-point sensor. After a discussion of the increasing scope of hygrometry in a variety of application fields in science, engineering and production, a review is given of humidity measuring methods. The most promising measuring method appears to be the determination of the dew-point temperature. It is shown that the integreted circuit technology can be applied successfully for the realization of accurate dew-point sensors. Three types of integrated dew-point sensors made with a standard IC-process or compatible technology are described. Based on an error analysis, a continuously operating dew-point hygrometer system was designed. This system consist of, beside the designed integrated sensor, a special control system for thermoelectrically controlled cooling, and data processing unit for selected presentation of the most important humidity quantities. R.J.F.

**N82-14494*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**AN EXPERIMENTAL INVESTIGATION INTO THE FEASIBILITY OF A THERMOELECTRIC HEAT FLUX GAGE**
Jan C. Jones (Tri State Univ.) and G. James VanFossen, Jr. Dec. 1981 17 p refs
(NASA-TM-82755; E-1071) Avail: NTIS HC A02/MF A01 CSCL 14B

An experiment was conducted to determine the feasibility of using a commerically available thermoelectric device as a heat flux gage. In certain research applications, the thermoelectric heat flux gage can provide a relatively simple means to model a warm fluid--cold wall. The experiment showed that heat flux through the gage could be correlated within two percent to the applied thermoelectric current through the device and the hot and cold side temperature with a simple algebraic equation.
Author

**N82-14495#** Defence Research Establishment Valcartier (Quebec).
**A STARK CELL FOR FREQUENCY CONTROL OF A WAVEGUIDE CO2 LASER**
P. Lavigne, A. Deslauriers, and J. Lemay Feb. 1981 30 p refs
(AD-A104734; DREV-R-4188/81) Avail: NTIS HC A03/MF A01 CSCL 20/5

In this report, we describe the mode of operation and the design of a Stark cell suitable for the frequency control of a local oscillator at 10 micrometers, and we analyze its characteristics. Using this cell, a waveguide CW CO2 laser was tuned over + or - 100 MHz around the line center of the P(20) CO2 line, at 10.6 micrometers, and a long-term frequency stability better than + or - 1.5 MHz was achieved. Author (GRA)

**N82-14496#** Stanford Linear Accelerator Center, Calif.
**TWO-DIMENSIONAL BEAM-PROFILE MONITOR USING THE RETICON MC510A ARRAY CAMERA**
B. Gottschalk Aug. 1981 70 p refs
(Contract DE-AC03-76SF-00515; Grant NSF PHY-79-20821)
(DE81-030853; SLAC-TN-81-7) Avail: NTIS HC A04/MF A01

A quantitative two dimensional beam profile may be obtained from a scintillator viewed by a Reticon camera which uses a 32 x 32 array of photodiodes as its sensing element. CAMAC oriented data acquisition electronics, which allow one either to transmit the profile to a computer or to use the monotor in a stand alone mode, are described. DOE

**N82-14497#** Oak Ridge National Lab., Tenn. Industrial Safety and Applied Health Physics Div.
**PERFORMANCE OF A LARGE HYPERPURE GERMANIUM DETECTOR ARRAY FOR IN-VIVO DETECTION OF LOW-ENERGY PHOTON AND X-RAY EMITTERS: ANALYTICAL PROCEDURE AND CURRENT CAPABILITIES**
C. D. Berger and B. H. Lane Oct. 1981 23 p refs
(Contract W-7405-eng-26)
(DE82-000443; ORNL/TM-7925) Avail: NTIS HC A02/MF A01

The ORNL whole body counter is one of the few in the country that is capable of assessment of body burdens of low-energy photon and X-ray emitters. This requires detectors and electronics specific for the task. Isotope identification and quantification capabilities are crucial at the facilities which deal with quantities of many radionuclides. Isotope identification and quantification capabilities for detection of the actinides using the HPGe array are greatly improved over the phoswich system, making the HPGe detector an integral part of lung counting operations at ORNL. The current analysis techniques are discussed, examples of MSMA and MDTA for various isotopes are given, and the derivation of a universal calibration curve for preliminary estimation of body burden is discussed using data acquired by the HPGe array. DOE

**N82-14498#** Exxon Nuclear Idaho Co., Inc., Idaho Falls.
**AUTOMATED TRANSPORTABLE MASS SPECTROMETER**
M. W. Echo Sep. 1981 45 p refs
(Contract DE-AC07-79ID-01675)
(DE82-000903; ENICO-1096) Avail: NTIS HC A03/MF A01

The need was identified for a mass spectrometer (MS) which can be conveniently transported among several facilities for rapid verification of the isotopic composition of special nuclear material. This requirement for a light weight, transportable MS for U and Pu mass analysis was met by deleting the gas chromograph (GC) portions of a Hewlett-Packard Model 5992 Quadrupole GCMS and substituting a vacuum lock sample entry system. A programmable power supply and vacuum gauge were added and circuitry modifications were made to enable use of the supplied software. DOE

**N82-14499#** Oak Ridge Gaseous Diffusion Plant, Tenn.
**PROCEDURES FOR THE CALCULATION OF THE SEPARATIVE PERFORMANCE OF A COUNTERCURRENT GAS CENTRIFUGE**
Edward VonHalle Jul. 1981 71 p refs Presented at the 4th Workshop on Gases in Strong Rotation, Oxford, 24-27 Aug. 1981
(Contract W-7405-eng-26)
(DE81 025448; K/OA-5013; CONF-810845-1) Avail: NTIS HC A04/MF A01

The approximations used in the development of the standard Onsager-Cohen gradient equation produce results which depart from the more detailed solutions presented in one direction in the enriching section and in the other direction in the stripping section and the errors therefore tend to cancel for the machine as a whole. It follows that for a centrifuge in which most of the bowl is used as an enriching section or as a stripping section this cancellation would not occur and some appreciable error would result from the use of the standard Onsager-Cohen gradient equation. A modified Onsager-Cohen gradient equation is therefore recommended in preference to the standard Onsager-Cohen gradient equation. It is shown in the results of calculations that indeed very little effect is observed by neglecting the term in the gradient equation containing the second derivative of the concentration. DOE

**N82-14500#** California Univ., Livermore. Lawrence Livermore Lab.
**COMPUTER MODELING OF PIEZORESISTIVE GAUGES**
G. L. Nutt and J. O. Hallquist 7 Aug. 1981 12 p refs Presented at the 1st Symp. on Gauges and Piezoresistive Mater., Archachon, Frances, 29 Sep. - 1 Oct. 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE81-027964; UCRL-85763; CONF-810931-2) Avail: NTIS HC A02/MF A01

A computer model of piezoresistive gauge subject to shock loading is developed. The time-dependent two-dimensional response of the gauge is calculated. The stress and strain components of the gauge are determined assuming elastic-plastic material properties. The model is compared with experiment for four cases. An ytterbium foil gauge in a PPMA medium subjected to a 0.5 Gp plane shock wave, where the gauge is presented

to the shock with its flat surface both parallel and perpendicular to the front. A similar comparison is made for a manganin foil subjected to a 2.7 Gp shock. The signals are compared also with a calibration equation derived with the gauge and medium properties accounted for but with the assumption that the gauge is in stress equilibrium with the shock medium. DOE

**N82-14501#** Rottenkolber Holo-System G.m.b.H., Obing (West Germany).
**MANUFACTURE AND TESTING OF A PROTOTYPE HOLOGRAPHIC SERIES TIRE TESTER Final Report**
Hans Rottenkolber Bonn Bundesministerium fuer Forschung und Technologie Dec. 1980 27 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-80-192; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5.70

The testing unit is for nondestructive tire testing, especially for retreads. The working conditions in the production area and the effects on the unit or its components were determined. The elaborated equipment draft meets production requirements. However, the cost is too high for broad application.
Author (ESA)

**N82-14502#** Schenck (Carl) A.G., Darmstadt (West Germany).
**AUTOMATIC BALANCING SYSTEM WITH LASER UNIT Final Report**
Alfred Giers Bonn Bundesministerium fuer Forschung und Technologie Jan. 1981 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-008; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5.90

A balancing plant for miniature rotor gyroscopes was developed, using a pulsed laser for material removal in order to perform the necessary measurements and balancing processes in one single operation. The plant, consisting of five units, is depicted and illustrated by graphs and photographs. The tests were intended to check the machine, to get experimental data, and to investigate the possibilities of this technology. As compared to conventional procedures, this automatic balancing process with laser compensation is rationalized, is faster, is cheaper, and provides a higher balancing quality. The test results confirm the system reliability as well as the process advantages.
Author (ESA)

**N82-14503#** Spindler und Hoyer G.m.b.H. und Co., Goettingen (West Germany).
**DEVELOPMENT OF A LINEAR MEASURING SYSTEM Final Report**
Detlef Mallwitz and Rainer Lessing Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 97 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-031; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20.20

Tests show that photographic coatings marked with corresponding graduations are usable for linear measuring systems. Processing of holographically produced gratings on adequate photo plates, the structures of which are appropriate for a linear measuring system is described. Gratings of this kind can be copied in a simple way under certain conditions. Two operational models are discussed which can be used in the range of the optical length measuring technique with digital indication of measured values. Author (ESA)

**N82-14504#** Zeiss (Carl), Oberkochen (West Germany).
**PMP 80 AUTOMATIC PHOTOMETER Final Report, Sep. 1979**
Goetz-Reinhard Lampe Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 32 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-051; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 6.70

Personnel and apparatus cost reduction as well as guaranteeing and improving the quality of the results are emphasized. This photometer permits interlaced measurement of the enzyme kinetics of several samples over a fairly long period of time and at a high sample rate. It also allows determination of substrate concentrations by end point measurements. In enzyme activity determinations, an aliquot volume of serum is added to the appropriate substrate and transferred to a transport chain with plastic cells. The samples are accurately thermostatically controlled in a contact thermostat. After the addition of the inducing reagent the samples are mixed. The sample chain is then fed to a microprocessor-controlled photometer which, after carrying out regression calculations, documents the activities plus errors on an integrated printer. Author (ESA)

**N82-14505#** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Bereich Raumfahrt.
**ANALYSIS AND CALCULATION OF SPECIAL SYSTEM ASPECTS FOR THE CONICAL SCAN RADIOMETER (PHASE A) Final Report**
Helmut Klostermann, Klaus Thoermer, and Wolfgang Ruehe Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 86 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-003; ISSN-0170-1339) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 18.10

Alternative concepts for a flexible radiometer system for Sun calibration were analyzed, imposing as few constraints as possible to the spacecraft system. The principal possibilities for the variation of the instantaneous field of view (FOV) were investigated in order to provide better data correlation for the wide FOV system. The influence of polarization on the system energy transfer function was calculated. Results make it possible to specify a system with higher performance concerning system calibration and geometrical data correlation. The theoretical limits of radiometric resolution due to polarization errors are given.
Author (ESA)

**N82-14120#** Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
**A HALLEY MULTICOLOR CAMERA**
H. U. Keller, C. Arpigny (Liege Univ.), C. Barbieri (Padua Univ.), P. Benvenuti (Padua Univ.), L. Biermann (Max-Planck Inst. fuer Physik und Astrophysik, Munich), R. M. Bonnet (CNRS, Verrieres-le-Buisson, France), S. Cazes (CNRS, Verrieres-le-Buisson, France), G. Colombo (Padua Univ.), C. B. Cosmovici (DFVLR, Oberpfaffenhofen, West Germany), W. A. Delamere (Ball Aerospace Systems Div., Boulder, Colorado) et al *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 105-117 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14390#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**THIN FILM TRANSDUCERS FOR TEMPERATURE AND HEAT FLUX MEASUREMENTS**
Jean-Claude Godefroy *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 9-19 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

## 36 LASERS AND MASERS

Includes parametric amplifiers.

**N82-14506#** California Univ., Santa Barbara. Quantum Inst.
**THE UCSB FREE ELECTRON LASER EXPERIMENTAL PROGRAM**
Luis R. Elias 1980 11 p refs
(AD-A106084; QIFEL-005/80) Avail: NTIS

HC A02/MF A01 CSCL 20/5

The main goal in this paper is threefold: (1) to present a summary of the UCSB experimental FEL program to date, (2) to discuss future FIL device development objectives, and (3) to talk briefly about the future of applied research at UCSB. Electrostatic accelerators appear to offer great promise for generating the electron beams needed by free electron lasers. Their conventional technology is well understood and there are good reasons to believe that this technology can be used with free electron lasers. The UCSB level experimental program is based on the use of electrostatic accelerators in conjunction with the ideas developed by Elias and Madey. GRA

**N82-14507#** Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

**TEMPERATURE DEPENDENCE OF O2 (1 DELTA) + O2 (1 DELTA) AND I (2P SUB 1/2) + O2 (1 DELTA) ENERGY POOLING**

Raymond F. Heidner, III, Carrol E. Gardner, G. I. Segal, T. M. El-Sayed, and J. V. V. Kasper (California Univ., Los Angeles) 1 Sep. 1981 38 p refs

(Contract F04701-80-C-0081)

(AD-A105817; TR-0081(6940-01)-2; SD-TR-81-65) Avail: NTIS HC A03/MF A01 CSCL 20/5

The electronic-energy pooling reactions forming O2(1 sigma) are of critical importance to the overall mechanism of the O2(1 delta) - I atom transfer laers. In this study, we report temperature-dependent rate coefficient data for O2(1 delta reactions). GRA

**N82-14508#** Naval Postgraduate School, Monterey, Calif.

**A PROBABLE BREAKDOWN MECHANISM IN THE ELECTRON BEAM SUSTAINED CO2 LASER M.S. Thesis**

Rodney Deayne Timm Jun. 1981 33 p refs

(AD-A105809) Avail: NTIS HC A03/MF A01 CSCL 20/5

A stable high-pressure electric discharge is produced using an electron-beam to ionize the gas in the CO2 -N2 -He laser. The important electron loss process in this type of discharge are recombination and attachment. The prominent instability in the nonself-sustaining discharge is the streamer which leads to arcing and complete breakdown of the gas. A qualitative analysis of streamer formation based on the ionization and resultant electron production of secondary electrons setup an avalanche starting the chain which produces a highly conductive channel and results in the complete breakdown of the gas is presented. The onset of streamer formation at the anode is aided by local release and ionization of neutral atoms. The resulting increase of the plasma pressure leads to an increase of the potential and the onset of unipolar arcing. Author (GRA)

**N82-14509#** Defence Research Establishment Valcartier (Quebec). Research and Development Branch.

**ANGLE OF ARRIVAL AND IRRADIANCE STATISTICS OF LASER BEAMS IN TURBULENCE**

L. Bissonnette and R. Cote Jul. 1981 45 p refs In ENGLISH; FRENCH summary

(AD-A105639; DREV-R-4213/81) Avail: NTIS HC A03/MF A01 CSCL 20/5

Measurement of the local angle of arrival in a laser beam traveling in turbulence is achieved by frequency demodulating the heterodyne signal derived from the interference of a probe and a reference beam. The resulting data are then used to demonstrate that the statistical correlation between the angle of arrival and the irradiance is weak and that the random angle of arrival is normally distributed. These results constitute a direct confirmation of two fundamental assumptions of the theoretical model of propagation in turbulence previously developed at the Defence Research Establishment Valcartier (DREV).

Author (GRA)

**N82-14510#** Defense Intelligence Agency, Washington, D.C. Directorate for Scientific and Technical Intelligence.

**BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 47, MAY - JUNE 1980**

9 Apr. 1981 124 p

(AD-A105585; DIA-DST-2700Z-002-81) Avail: NTIS HC A06/MF A01 CSCL 20/5

This is the Soviet Laser Bibliography for May-June 1980, and is No. 47 in a continuing series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics. Author (GRA)

**N82-14511#** Defense Intelligence Agency, Washington, D.C. Directorate for Scientific and Technical Intelligence.

**BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 48, JULY - AUGUST 1980**

Jul. 1981 138 p

(AD-A105578; DIA-DST-2700Z-003-81) Avail: NTIS HC A07/MF A01 CSCL 20/5

This is the Soviet Laser Bibliography for July-August 1980, and is No. 48 in a continuing series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement applications; laser-excited optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics. Author (GRA)

**N82-14512#** National Bureau of Standards, Washington, D.C. Electrical Measurements and Standards Div.

**LASER COOLING AND TRAPPING OF NEUTRAL ATOMS Summary Report, 1 Oct. 1980 - 30 Sep. 1981**

William D. Phillips Sep. 1981 5 p refs

(Contract N00014-81-F-0011; RR0110303; NR Proj. 407-007)

(AD-A105750) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report demonstrated the deceleration of an atomic sodium beam by means of photon pressure. Near resonant light from a counter-propagating (cooling) laser beam is absorbed by the atoms, causing them to slow down. The deceleration is observed by means of Doppler velocity analysis using a second (probe) laser. We modulate the cooling laser on and off while using time resolved observation of the fluorescence induced by the second laser; this allows observation of the effects of the cooling laser when the cooling laser light is not present. We have used circularly polarized light and a strong magnetic field in the direction of the cooling laser to avoid optical pumping of the atoms, a process which limits the amount of momentum which can be transferred to the atoms. GRA

**N82-14513#** Illinois Univ. at Urbana.

**HOT ELECTRON EFFECTS OF IMPORTANCE FOR MICRON AND SUBMICRON DEVICES Final Report**

K. Hess and G. E. Stillman Sep. 1981 77 p refs

(Contract N00014-79-C-0768)

(AD-A105616) Avail: NTIS HC A05/MF A01 CSCL 20/5

During the period of this contract fifteen papers have been published. The manuscripts concern lateral transport in superlattices, transport at extremely high electric fields and impact ionization and quantum well heterojunction lasers. Author (GRA)

**N82-14514#** California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Chemistry.

**LASER-INDUCED-FLUORESCENCE STUDIES OF FRAGMENT IONS: CH( ) AND CD( ) Ph.D. Thesis**

Anthony OKeefe Aug. 1981 114 p refs

(Contract W-7405-eng-48)

(DE82-001010; LBL-13258) Avail: NTIS HC A06/MF A01

The dynamics of ion molecular interactions within a mass selective rf quadrupole ion trap were studied for several ion molecule systems. Laser induced fluorescence is used as a probe of the internal energy distributions of molecular ions under collision free conditions and under controlled collision conditions. The ions were produced from methane through electron impact ionization/dissociation. The energy distributions reflect the

dynamical partitioning of dissociation exothermicity, excepting short lived electronic states. DOE

**N82-14515#** California Univ., Livermore. Lawrence Livermore Lab.
**NONADIABATIC CORRECTIONS AND DETRAPPING FOR VARIABLE PARAMETER FREE ELECTRON LASERS**
J. C. Garrison and J. Wong 10 Aug. 1981 18 p refs Presented at the 1981 Workshop on Free Electron Lasers, Sun Valley, Idaho, 22 Jun. 1981
(Contract W-7405-eng-48)
(DE81-028425; UCRL-86568; CONF-8106145-1) Avail: NTIS HC A02/MF A01

In analytical treatments of free electron laser (FEL) problems an adiabatic, approximation is used in which the electron orbits are calculated as though the wiggler and signal fields were constant. The slow spatial variations of the field amplitudes are then reinstated at the end of the calculation. A check to see if secular effects are present in the corrections to the adiabatic approximation for FEL problems is described. The nonstatic action angle transformation produces a new Hamiltonian in which the nonadiabatic effects are explicitly given by the term g kappa. Perturbation expansions in g are valid in the interior of the trapping region with the exception of an exponentially small neighborhood of the separatrix. By using Lie transform perturbation theory it was found that secular effects are absent to O(g), and the O(g2) secular effects are not important in the FEL application. DOE

**N82-14516#** Los Alamos Scientific Lab., N. Mex.
**LASER-INDUCED FLUORESCENCE TECHNIQUE TO MONITOR H2S (PR 16023) Quarterly Technical Progress Report, 1 May 1981 - 31 Jul. 1981**
30 Jul. 1981 6 p
(Contract W-7405-eng-48)
(DE81-028784; DOE/TIC-1028784) Avail: NTIS HC A02/MF A01

A means to detect H2S at the 0.1-ppM level via laser induced fluorescence (LIF) was developed. The upper electronic states of H2S are repulsive, which necessitates the use of a two laser pump probe technique. The fluorescence signal is related back to the H2S concentration prior to dissociation and affords a real time diagnostic for the species of interest. DOE

**N82-14517#** Technische Hochschule, Darmstadt (West Germany). Inst. fuer Angewandte Physik.
**HIGH POWER GAS LASER FOR MATERIAL PROCESSING OF ORGANIC AND INORGANIC MATERIAL Final Report**
Gerd Herziger and Karlheinz Banse Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-025; ISSN-0340-7608) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 20,40

Gas lasers in the ultraviolet range were tested with respect to their applicability for micromachining of thin films. A system which is able to remove volumes < 1 cu micron of target supporting layers, without damaging them or their surroundings was developed. A KrF TEA excimer laser proved to be best suited. With this system, the projected performance (P = 50.000W T = or > 2 X 10E minus 8sec) is exceeded. The direct absorption of 40 to 100 nsec laser pulses in the target yields shock free material processing. Long pulse TEA laser action, however, is only realized if preionization and system parameters are properly adjusted so that the laser discharge is homogeneous throughout the whole pulse length. The expected advantages of short wavelengths with regard to direct absorption of radiation in the target at reduced shock load was demonstrated. Author (ESA)

**N82-14518#** Haas (Carl) G.m.b.H. und Co., Schramberg (West Germany). Geschaeftsbereich Strahltechnik.
**LASER TOOL: PULSED SOLID STATE LASER FOR WELDING AND ABLATION OF MATERIAL Final Report, Sep. 1979**
Paul Seiler Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 20 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-043; ISSN-0340-7608) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 4,20

A system of lasers, focusing and viewing optics, control and power electronics, coolers and mechanical components, was designed. The incorporated Nd-glass pulsed lasers have pulse energies up to 100 Wsec and average output powers up to 100 W. The machines are used in precision and electrical engineering, mainly combined with industrial handling. Being ideally suited for automation, this method has a wide range of application in the field of spot and seam welding of small parts and is widely used to make electric contacts. Author (ESA)

**N82-14389#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**KrF LASER PUMPING BY ELECTRON BEAM DISCHARGE**
Jean Bonnet, Gerard Fournier, and Daniel Pigache *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 3-7 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

# 37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

**N82-14519*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**APPLICATION OF SURFACE ANALYSIS TO SOLVE PROBLEMS OF WEAR**
Donald H. Buckley 1981 35 p refs Presented at the Ideele Traeger der SURTEC Berlin '81, West Germany, 29 Jun. - 3 Jul. 1981
(NASA-TM-82753; E-1069) Avail: NTIS HC A03/MF A01 CSCL 20K

Results are presented for the use of surface analytical tools including field ion microscopy, Auger emission spectroscopy analysis (AES), cylindrical mirror Auger analysis and X-ray photoelectron spectroscopy (XPS). Data from the field ion microscope reveal adhesive transfer (wear) at the atomic level with the formation of surface compounds not found in the bulk, and AES reveals that this transfer will occur even in the presence of surface oxides. Both AES and XPS reveal that in abrasive wear with silicon carbide and diamond contacting the transition metals, the surface and the abrasive undergo a chemical or structural change which effects wear. With silicon carbide, silicon volatilizes leaving behind a pseudo-graphitic surface and the surface of diamond is observed to graphitize. B.W.

**N82-14520#** Massachusetts Inst. of Tech., Cambridge. National Magnet Lab.
**CONCEPTUAL DESIGN OF SUPERCONDUCTING MAGNET SYSTEM FOR MAGNETOHYDRODYNAMIC (MHD) ENGINEERING TEST FACILITY (ETF) 200 MWe POWER PLANT Final Report**
Nov. 1981 259 p refs
(Grant NAG3-100)
(NASA-CR-165053; FBNML-NAS-E-2) Avail: NTIS HC A12/MF A01 CSCL 14B

A super conducting magnet system conceptual design to meet the requirements of a magnetohydrodynamic test facility power train is presented. A detailed description of the magnet is accompanied by numerous engineering drawings. Functional requirements, system interfaces, and design criteria are reviewed. System limits, safety precautions, operational procedures, and maintenance procedures are discussed. R.J.F.

**N82-14521#** Ballistic Research Labs., Aberdeen Proving Ground, Md.
**MEASUREMENT PROBLEMS IN HIGH VELOCITY IMPACT EXPERIMENTS Final Report**

William Lawrence Sep. 1981 39 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A105550; ARBRL-MR-03135) Avail: NTIS HC A03/MF A01 CSCL 19/4

Reverse-ballistic experiments have been performed at the Ballistic Research Laboratory using a light-gas gun to launch targets against stationary long-rod projectiles instrumented with foil type resistance strain gages. Signals from the strain gages are recorded, measured and analyzed to obtain information about the dynamic behavior of the projectile as it penetrates the target. Signals from the strain gages are commonly divided so that part of the signal may be displayed at higher amplification for better resolution of detail at low strains. Data recorded at different deflection sensitivities and data from gages at diametrically opposed locations on the projectiles are combined for the analysis. Error in the data reduction, especially error in time, is apparent from the poor agreement of the combined data. Different sources of error have been identified but the primary source is optical distortion in the oscilloscope cameras and in the copying camera. This report briefly reviews the instrumented rod experiment and the analytical procedure but primarily considers sources of error. A modified calibration procedure is introduced to minimize the error in the data reduction. Author (GRA)

**N82-14522#** Petro-Lewis Corp., Denver, Colo.
**FIELD DEMONSTRATION OF THE CONVENTIONAL STEAM DRIVE PROCESS WITH ANCILLARY MATERIALS Quarterly Report, Jul. - Sep. 1980**
David R. Alden and Rod L. Eson (Chemical Oil Recovery Co., Bakersfield, Calif.) 7 Oct. 1980 13 p
(Contract DE-FC03-79SF-10762)
(DE81-026849; DOE/SF-10762/T2) Avail: NTIS HC A02/MF A01

This field test demonstrates an improved oil recovery process through the use of ancillary materials to steam drive injectors. The ancillary materials are used to reduce injection in steam channels and thus force the injected steam to enter alternate flow paths. Evaluation of the injection well production curves shows that currently there is over 125 incremental barrels of oil per day being produced by the four patterns receiving ancillary materials and that the incremental oil rate has been steadily increasing since the initial treatment in January, 1980. Preliminary work began on the evaluation of the producing temperatures, steam injection profiles, chemical tracer surveys, casing vent gas emissions and residual oil saturations in the six observation wells drilled. DOE

**N82-14523#** Chemical Oil Recovery Co., Bakersfield, Calif.
**FIELD DEMONSTRATION OF THE CONVENTIONAL STEAM DRIVE PROCESS WITH ANCILLARY MATERIALS Quarterly Report, Oct. - Dec. 1980**
Rod L. Eson and A. M. Shannon (Petro-Lewis Corp., Denver) Jan. 1981 28 p
(Contract DE-FC03-79SF-10762)
(DE81-026962; DOE/SF-10762/T1) Avail: NTIS HC A03/MF A01

This field test demonstrates an improved oil recovery process through the use of ancillary materials to steam drive injectors. The ancillary materials are used to reduce injection in steam channels and thus force the injected steam to enter alternate flow paths. During the first two months of this quarter up to 190 incremental barrels of oil per day were produced by the four patterns receiving ancillary materials. The evaluation of the producing temperatures, steam injection profiles, chemical tracer surveys, casing vent gas emissions and residual oil saturations in the six observation wells drilled is addressed. DOE

**N82-14524#** Institut de Soudure, Paris (France).
**STUDY OF PROBLEMS POSED BY THE EMISSION OF FUMES DURING WELDING Final Report [ETUDE DES PROBLEMES POSES PAR L'EMISSION DE FUMEES AU COURS DU SOUDAGE]**
Senlis, France Centre Technique des Industries Mecaniques Jan. 1981 78 p refs In FRENCH
(Contract CETIM-4-76-2693)
(CETIM-12-Y-213; IS-7-989) Avail: NTIS HC A05/MF A01

Application of a measurement method for sampling and analyzing dust in the fumes is described. Arc welding using a rutile coated electrode of painted sheet metal is characterized. Results show the instantaneous dust concentration to which a welder is subjected at his work station. The measuring equipment is depicted and its functioning is explained. Author (ESA)

# 38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

**N82-14525#** General Electric Co., St. Petersburg, Fla. Atomic Power Lab.
**ULTRASONIC INSPECTION OF FULL-SIZE BOLTING SPECIMENS**
T. A. Wagner, P. Anderson, and D. A. Gavin Nov. 1980 20 p Presented at the ASNT Fall Conf., Atlanta, 12 Oct. 1981
(Contract DE-AC12-76SN-00052)
(KAPL-4129; CONF-811003-1) Avail: NTIS HC A02/MF A01

The development and use of an automatic ultrasonic inspection procedure for bolts with heater bores are described. Application of the procedure to accelerated lifetime studies in full-size bolting specimens is explained. Inspection results and conclusions are given. DOE

**N82-14526#** Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
**COMPUTER PROGRAM DESIGN: METHODOLOGY, RELIABILITY, AND QUALITY CONTROL [GENIE LOGICIEL: METHODOLOGIE, ASSURANCE ET CONTROLE QUALITE]**
Elie Dorio Jan. 1981 289 p In FRENCH; ENGLISH summary
(CNES-NT-98) Avail: NTIS HC A13/MF A01

Software methodologies are considered, including definition of program requirements, program design, coding, tests and maintenance. Project management on the levels of computer program production, verification, and certification is discussed. The need for discipline in software engineering practices in order to find realistic solutions to programming problems is emphasized. A program quality control method is presented as an example. Inspection techniques, operations organization, objectives and expected results are specified. Author (ESA)

**N82-14527#** Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.
**CONTROL METHODOLOGY: NONDESTRUCTIVE TESTING IN THE AERONAUTICS INDUSTRY [METHODOLOGIE DE CONTROLE: CONTROLE NON DESTRUCTIF DOMAINE AERONAUTIQUE]**
J. Odorico 12 Jun. 1980 39 p refs In FRENCH Presented at l'Ecole d'Ete Franco-Quebecoise Conf., Montreal, 14-23 Jul. 1980
(SNIAS-812-551-110) Avail: NTIS HC A03/MF A01

Quality control in aircraft production using nondestructive tests is considered. Training and administration are covered. Examples of procedures involving suppliers, constructors, and clients are given. Topics include: use of X-rays; holography; examination of alloys; and ultrasonic testing. The need for an integrated approach is stressed, involving client, inspectors, etc. Author (ESA)

**N82-14158#** Mathematischer Beratungs- und Programmierungsdienst G.m.b.H. Dortmund (West Germany).
**QUALITY CONTROL FOR MISSION-CRITICAL FLIGHT DYNAMIC OPERATIONS**
H. Mueller and R. E. Muench (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 333-340 ref
(For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20 % others)

# 39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

**N82-14528#** Indian Inst. of Tech., Bombay. Dept. of Aeronautical Engineering.
**COUPLED FLEXURAL TORSIONAL VIBRATION OF AN ECCENTRICALLY STRETCHED STRIP**
S. Suryanarayan and Ashok Joshi Mar. 1981 14 p
(AE-TN-8131) Avail: NTIS HC A02/MF A01

Flat rectangular strips subjected to an eccentric axial load exhibit coupled transverse lateral torsional modes of vibration. The coupling between the transverse lateral and torsional modes depends on the axial load and the amount of eccentricity. The effect is to increase the torsional frequency and to decrease the transverse lateral frequency. S.L.

**N82-14529*#** Flow Research, Inc., Kent, Wash.
**DEVELOPMENT OF AN EFFICIENT PROCEDURE FOR CALCULATING THE AERODYNAMIC EFFECTS OF PLANFORM VARIATION Final Report**
J. E. Mercer and E. W. Geller Washington NASA Dec. 1981 36 p refs
(Contract NAS1-15977)
(NASA-CR-3489; FLOW-RR-186) Avail: NTIS HC A03/MF A01 CSCL 20K

Numerical procedures to compute gradients in aerodynamic loading due to planform shape changes using panel method codes were studied. Two procedures were investigated: one computed the aerodynamic perturbation directly; the other computed the aerodynamic loading on the perturbed planform and on the base planform and then differenced these values to obtain the perturbation in loading. It is indicated that computing the perturbed values directly can not be done satisfactorily without proper aerodynamic representation of the pressure singularity at the leading edge of a thin wing. For the alternative procedure, a technique was developed which saves most of the time-consuming computations from a panel method calculation for the base planform. Using this procedure the perturbed loading can be calculated in about one-tenth the time of that for the base solution. Author

**N82-14530*#** Rohr Industries, Inc., Chula Vista, Calif.
**FABRICATION OF TITANIUM MULTIWALL THERMAL PROTECTION SYSTEM (TPS) CURVED PANEL Interim Report**
W. Blair Hampton, Va. NASA. Langley Research Center Aug. 1981 29 p refs
(Contract NAS1-15646)
(NASA-CR-165754) Avail: NTIS HC A03/MF A01 CSCL 20K

A method is described for fabricating curved T1-6Al-4V multiwall panels having a single radius of curvature of 30.5 cm (12 inches). A panel 30.5 x 30.5 x 1.7 cm (12 x 12 x .688 inch) having 4 dimpled sheets, 5 undimpled sheets, and stepped side closures was designed, fabricated and delivered for evaluation. Tool design for skin and dimpled sheet forming are described as well as layup and liquid interface diffusion bonding. A.R.H.

**N82-14531*#** Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
**THE APPLICATION OF PROBABILISTIC DESIGN THEORY TO HIGH TEMPERATURE LOW CYCLE FATIGUE**
Paul H. Wirsching Nov. 1981 224 p refs
(Grant NAG3-41)
(NASA-CR-165488) Avail: NTIS HC A10/MF A01 CSCL 20K

Metal fatigue under stress and thermal cycling is a principal mode of failure in gas turbine engine hot section components such as turbine blades and disks and combustor liners. Designing for fatigue is subject to considerable uncertainty, e.g., scatter in cycles to failure, available fatigue test data and operating environment data, uncertainties in the models used to predict stresses, etc. Methods of analyzing fatigue test data for probabilistic design purposes are summarized. The general strain life as well as homo- and hetero-scedastic models are considered. Modern probabilistic design theory is reviewed and examples are presented which illustrate application to reliability analysis of gas turbine engine components. A.R.H.

**N82-14532#** Technische Hogeschool, Delft (Netherlands).
**A GEOMETRICALLY NONLINEAR FINITE ELEMENT SHELL THEORY Ph.D. Thesis**
Leo Johan Ernst 1981 265 p refs
Avail: NTIS HC A12/MF A01

A curved triangular thin, elastic finite shell element is presented with expressions for the deformation tensors in terms of cartesian displacement components. In deriving these expressions the element is considered and originally flat plate with initial curvature. Approximations are accepted in the specification of the element geometry. Consequently the expressions for the deformation tensors are approximations are provided. An important parameter used in the error estimates is the maximum slope, theta, of middle surface of the element with respect to its basic triangle. This parameter vanished with continuously decreasing linear dimensions of the elements. Approximate deformation tensors are derived both in terms of displacement components with respect to the original reference position and with respect to a special reference position. The latter description is especially suitable for caes with arbitrary large displacements and rotations, since a possible rigid body motion of the element is separated from the displacement pattern. S.L.

**N82-14533*#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
**USE OF TWO-DIMENSIONAL TRANSMISSION PHOTOELASTIC MODELS TO STUDY STRESSES IN DOUBLE-LAP BOLTED JOINTS Contractor Report, Apr. 1980 - Jun. 1981**
M. W. Hyer and D. H. Liu Nov. 1981 111 p refs Sponsored in part by Army
(Grant NsG-1621)
(NASA-CR-165812) Avail: NTIS HC A06/MF A01 CSCL 20K

The stress distribution in two hole connectors in a double lap joint configuration was studied. The following steps are described: (1) fabrication of photoelastic models of double lap double hole joints designed to determine the stresses in the inner lap; (2) assessment of the effects of joint geometry on the stresses in the inner lap; and (3) quantification of differences in the stresses near the two holes. The two holes were on the centerline of the joint and the joints were loaded in tension, parallel to the centerline. Acrylic slip fit pins through the holes served as fasteners. Two dimensional transmission photoelastic models were fabricated by using transparent acrylic outer laps and a photoelastic model material for the inner laps. It is concluded that the photoelastic fringe patterns which are visible when the models are loaded are due almost entirely to stresses in the inner lap. E.A.K.

**N82-14534#** Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Applied Mathematics Group.
**DETERMINATION OF COMPLEX CHARACTERISTICS VALUES AND VECTORS FROM SINUSOIDAL EXCITATIONS AT NEAR RESONANCE FREQUENCIES Interim Report, Aug. 1978 - Jun. 1980**
C. L. Keller Jun. 1981 133 p refs
(AF Proj. 2304)
(AD-A105624; AFWAL-TR-80-3136) Avail: NTIS HC A07/MF A01 CSCL 20/11

In this report an iterative procedure for determining complex characteristic values and vectors from measured values of the steady state response to sinusoidal excitations is described. An extension of the procedure which enables it to cope with the case of two close characteristic values is presented also. Results of numerical experiments performed to investigate these procedures are given. This report contains also extensive background material and an examination of the methods of Ibrahim, of Wittmeyer and of Link and Vollan. Author (GRA)

**N82-14535#** California Univ., Berkeley. Dept. of Mechanical Engineering.
**SMALL STRAIN ACCOMPANIED BY MODERATE ROTATION**
P. M. Naghdi and L. Vongsarnpigoon Aug. 1981 58 p refs
(Contract N00014-75-C-0148; NR Proj. 064-436)
(AD-A105592; UCB/AM-81-4) Avail: NTIS HC A04/MF A01 CSCL 20/11

This paper is mainly concerned with the construction of a theory of material behavior with infinitesimal strain accompanied by moderate rotation. After introducing a definition for moderate rotation and establishing a number of theorems pertaining to its properties, precise estimates are obtained for the (local) moderate rotation and related kinematical results in terms of infinitesimal strain. For motions which result in small strain accompanied by moderate rotation, the invariance of constitutive equations under arbitrary superposed rigid body motions is discussed with particular reference to an elastic material. Author (GRA)

**N82-14536#** Maryland Univ., College Park. School of Engineering.
**STRESS DISTRIBUTION AROUND A CIRCULAR HOLE IN SQUARE PLATES, LOADED UNIFORMLY IN THE PLANE, ON TWO OPPOSITE SIDES OF THE SQUARE. OPTIMUM SHAPES OF CENTRAL HOLES IN SQUARE PLATES SUBJECTED TO UNIAXIAL UNIFORM LOAD. OPTIMIZATION OF HOLE SHAPES IN CIRCULAR CYLINDRICAL SHELLS UNDER AXIAL TENSION**
M. Erickson, A. J. Durelli, and K. Rajaiah Sep. 1981 39 p refs
(Contracts N00014-81-K-0186; N00014-76-C-0487)
(AD-A105598; Rept-55; Rept-56; Rept-57) Avail: NTIS HC A03/MF A01 CSCL 20/11

The following three reports are being distributed together and reprints of the papers previously published with their texts in scientific journals are used for the purpose. Circumstantial reasons, primarily cost, made this procedure advisable. One of the reports (56) deals with the optimization of the shape of an originally circular hole present in a square plate, loaded uniformly and uniaxially in its plane. A second report (57) deals with the optimization of the shape of the hole, when the hole is present in a cylindrical shell subjected to axial tension. The third report (55) deals with the necessary background for the optimization of the hole in the square plate. GRA

**N82-14537#** Naval Weapons Center, China Lake, Calif.
**STRESS IN SINGLE LAP JOINTS OF DISSIMILAR MATERIALS Research Report, 1979 - 1980**
W. J. Stronge and O. E. R. Heimdahl Jun. 1981 22 p refs (ZR0000101)
(AD-A105519; AD-E900131; NWC-TP-6264) Avail: NTIS HC A02/MF A01 CSCL 13/5

Two overlapping, semi-infinite plates may be joined by a thin adhesive bond. The stresses in these joints when the plates are loaded in tension are of interest for determining joint strength. A two-dimensional, plane strain, finite element analysis of bonded lap joints between dissimilar plates has been performed. The analysis includes stretching and bending of the plates and rotation of the joint. The stress distributions obtained for the lap joint depend on the elastic moduli and Poisson ratios of the adherends, and on the ratio of relative thickness of the plates to bond length. GRA

**N82-14538#** Oak Ridge National Lab., Tenn.
**TESTING PROGRAM FOR CONCRETE AT TEMPERATURES TO 894 DEG K**
D. J. Naus, C. B. Oland, and G. C. Robinson 1981 15 p refs Presented at the 6th Intern. Conf. on Struct. Mech. in Reactor Technol., Paris, 17 Aug. 1981
(Contract W-7405-eng-26)
(DE81-029144; CONF-810801-53) Avail: NTIS HC A02/MF A01

The variations in mechanical properties of a limestone aggregate concrete and a lightweight insulating concrete exposed to elevated temperatures were defined. Four test series were conducted: (1) unconfined compression; (2) shear; (3) rebar bond; and (4) sustained loading (creep). DOE

**N82-14539#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**HIGH-TEMPERATURE FATIGUE BEHAVIOR OF UNIRRADIATED V-15Cr-5Ti TESTED IN VACUUM**
K. C. Liu 1981 5 p refs Presented at Fusion Reactor Mater. Meeting, Seattle, 9 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028557; CONF-810831-19) Avail: NTIS HC A02/MF A01

In vacuum fatigue tests for unirradiated V-15Cr-5Ti tested at room temperature, 550 and 650 C, respectively, are presented. A power law equation to correlate the total strain range and cycles to failure was analyzed. It is shown that on the basis of strain range the vanadium alloy is about the same as the stainless steel below 10,000 cycles to failure but becomes superior above the point. It is suggested that endurance limits may exist at strain ranges of approximately 0.7 and 0.6% at 550 and 650 C, respectively. DOE

**N82-14540#** Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
**ELEVATED-TEMPERATURE (600 DEG F), MANUAL CONTACT ULTRASONIC EXAMINATION**
C. W. Donnelly 1981 8 p Presented at the ASNT Fall Conf., Atlanta, 12 Oct. 1981
(Contract DE-AC15-76CL-02395)
(CONF-811003-2) Avail: NTIS HC A02/MF A01

Manual contact ultrasonic examination at temperatures above 250 F is not successful in providing meaningful results because the sensitivity of standard transducers degrades rapidly at 250 F and above. By using standard transducers and commercially available wedges and couplants in combination with a couplant/cooler system, manual contact ultrasonic examination is performed at 600 F for an essentially 100 percent duty cycle in conformance to the sensitivity requirement of the ASME B and PV Code. DOE

**N82-14541#** Institut de Soudure, Paris (France).
**STUDY OF THE FATIGUE BEHAVIOR OF WELDED JOINTS, CROSS STRESSED Final Report [ETUDE DU COMPORTEMENT A LA FATIGUE DE JOINTS SOUDES SOLLICITES SELON LE TRAVERS COURT]**
F. Maltrud Senlis, France Centre Technique des Industries Mecaniques 28 Aug. 1980 57 p In FRENCH
(Contract CETIM-4-76-2692)
(CETIM-12-Y-200; IS-10-830) Avail: NTIS HC A04/MF A01

Fatigue tests were carried out on welded steel specimens. The influence of inclusions in the welded specimens on fatigue resistance was studied. Results show that inclusions influence fatigue behavior only when they provoke damage before fatigue testing. For example, damage can occur due to stresses which develop during welding of flanged specimens. Barring damage beforehand, fatigue performance of cross stressed assemblies is independent of the presence of inclusions. This behavior is illustrated by the ultrasonic detection of inclusions in specimens and by measurements of crack propagation velocity.
Author (ESA)

**N82-14542#** Institut de Soudure, Paris (France).
**FATIGUE TEST PROGRAM ON NOTCHED IMPLANTED SPECIMENS, CRACKED AND UNCRACKED Final Report [PROGRAMME D'ESSAIS DE FATIGUE SUR IMPLANTS ENTAILLES, FISSURES OU NON]**
M. S. Debiez and J. P. Doucet Senlis, France Centre Technique des Industries Mecaniques Sep. 1980 42 p refs In FRENCH
(Contract CETIM-4-77-5622)
(CETIM-12-Y-261; IS-10-882) Avail: NTIS HC A03/MF A01

The influence of the geometry as well as of the presence of a cold crack on the fatigue behavior of zones subjected to thermal stresses was studied. The S-N curves do not show the expected differences for the variables tested, but rather indicate that crack geometry and presence are not determining factors with a notch of acute dimensions. The minimal endurance obtained for three types of steel (annealed E 36, E 620, and 25 CD 4) is 150 N/sq mm under cyclic traction. A fracture mechanical analysis was also performed. Results are only valid for uncracked notched specimens. Crack initiation and propagation phases

are described and their coefficients are shown dependent on structure. Author (ESA)

**N82-14543#** Ecole Nationale Superieure de Techniques Avancees, Paris (France).
**STRESS-STRAIN ANALYSIS OF VERY THICK PLATES Ph.D. Thesis - Paris Univ. 6 [ANALYSE DES CONTRAINTES ET DES DEPLACEMENTS DANS LES PLAQUES TRES EPAISSES]**
El Dessouki El Said ElSoaly Sep. 1980 251 p refs In FRENCH; ENGLISH summary
(Rept-138) Avail: NTIS HC A12/MF A01

Theoretical, experimental and numerical analyses of thick isotropic homogeneous plates under different loading conditions are presented. The theory takes into account the effects of transverse shear deformation. The analysis uses a variational theorem, having the longitudinal displacements, the transverse shear stresses and the transverse normal stress as variables. The displacement and stress fields are expressed as finite series. Each term of these series is the product of two functions: the first is a given function of the normal transverse variable and the second is an unknown function of the middle plane variables. These expressions are handled as a functional. The third equation of equilibrium and the boundary conditions on the upper and lower surfaces of the plate are satisfied by introducing a Lagrange multiplier which has the significance of a generalized deflection. A complete system of partial differential equations and boundary conditions is sufficient to determine all the unknown functions results. Author (ESA)

**N82-14544#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-Forschung.
**THE CRACK GROWTH RESISTANCE CURVE AS A ONE-PARAMETER REPRESENTATION OF STABLE CRACK PROPAGATION IN THIN-WALLED STRUCTURES Ph.D. Thesis - Ruhr Univ.**
Werner Setz Oct. 1980 268 p refs In GERMAN; ENGLISH summary Report will also be announced as translation ESA-TT-727
(DFVLR-FB-80-35; ESA-TT-727) Avail: NTIS HC A12/MF A01; DFVLR, Cologne DM 41,60

Tensile tests were performed on center cracked specimens with aluminum alloys. The effect of the variation in specimen width and the initial crack length growth resistance curve (R-curve) was investigated. The crack length was measured simultaneously by the potential and the compliance method. The potential method yields less scatter than the compliance method. The potential based R-curves were used to predict failure by the R-curve concept. The failure prediction for elastic plastic behavior supports a standard test method using R-curve measurements. Author (ESA)

**N82-14545** Rensselaer Polytechnic Inst., Troy, N. Y.
**LASER SPECKLE DOPPLER VELOCIMETER TECHNIQUE APPLIED TO MEASURE TORSIONAL VIBRATIONS OF ROTATING SURFACES Ph.D. Thesis**
Seetha Ramaiah Mannava 1981 245 p
Avail: Univ. Microfilms Order No. 8123386

A dual beam Laser Speckle Doppler Velocimeter technique was developed to measure torsional vibrations of rotating surfaces. A closed form analytical solution of this noncontact optical sensor was developed from fundamental principles using electromagnetic Helmholtz formulation of Huygens-Fresnel principle with Kirchhoff's approximations of the boundary conditions for the scattered light from a rough surface whose height above a certain mean level is approximated by a Gaussian probability density function. Laboratory experiments conducted using the Laser Speckle Doppler Velocimeter on a rotating disk spinning at 60 r/s and torsionally excited in the frequency range of zero to 10 Hz are in excellent agreement with the analytical results. Dissert. Abstr.

**N82-14546** Purdue Univ., Lafayette, Ind.
**DYNAMIC SAFETY ANALYSIS Ph.D. Thesis**
H. Scott Norville 1981 117 p
Avail: Univ. Microfilms Order No. 8123685

A method is developed to compute first-passage probabilities for linear elastic structures subjected to random base accelerators. The base accelerations consist of both horizontal and vertical components. Specifically, the effect of the vertical accelerations on the first passage probabilities are investigated. The solution of the first-passage problem is accomplished by discretizing the process in both space and time. Spatial barriers are placed on the response process of the structure. The probabilities associated with the structural response remaining within the specified barriers are computed. For a single-story frame undergoing horizontal accelerations, the model of the frame is seen to have a significant effect on first passage probabilities. For a two-story frame, only a shear frame model is used. First-passage probabilities are computed for arbitrary barriers on the displacement responses of the stories under the action of horizontal base accelerations only. Dissert. Abstr.

**N82-14547** California Univ., Los Angeles.
**INFLUENCE OF A FREE SURFACE ON THE ELASTODYNAMIC FIELD OF A FINITE CRACK Ph.D. Thesis**
Steven F. Stone 1981 190 p
Avail: Univ. Microfilms Order No. 8122857

The effects of the presence of a free surface on the stress and displacement field in the neighborhood of and at large distances away from a crack of finite length subject to time dependent loading is studied. The crack is assumed to be arbitrarily oriented and an arbitrary distance from the free surface. Both antiplane and inplane cases are considered. For each problem, the low and intermediate frequency dependent crack opening displacements and stress factors are calculated by solving the integral equations. High frequency asymptotic methods are employed to complete the solution. Expressions are developed for diffracted fields and surface displacements for incident Rayleigh waves calculated for the inplane problem. Results indicate the location and orientation of a crack with respect to a free surface can profoundly effect the field quantities in the neighborhood of the crack and the subsequent tendency of the crack to propagate. Dissert. Abstr.

**N82-14391#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**DESCRIPTION AND NUMERICAL SIMULATION OF THERMAL FATIGUE TESTS ON SMOOTH SPECIMENS**
Georges Cailletaud, Jean-Pierre Culie, and Henri Kaczmarek *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 21-33 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

**N82-14392#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**HOMOGENIZATION METHOD FOR REINFORCED PLATE BUCKLING PREDICTION**
Pierre Suquet *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1981-2, Mar. - Apr. 1981 (ESA-TT-713) Sep. 1981 p 35-43 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimensuel (Paris) No. 1981-2, Mar. - Apr. 1981 (For primary document see N82-14388 05-31)
Avail: NTIS HC A05/MF A01; original FRENCH report available at ONERA, Paris FF 45

## 42 GEOSCIENCES (GENERAL)

No abstracts in this category.

# 43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

**N82-14548*#** Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

**RADAR CORRELATION WITH ICE DEPOLARIZATION MEASUREMENTS OF THE 28,56 GHz COMSTAR BEACON AND ASSOCIATED CROSS POLARIZATION STATISTICS**

Julius Goldhirsh Aug. 1980 51 p refs

(NASA-CR-166717; JHU/APL-SIR-80U-026) HC A04/MF A01 CSCL 08L

Two cases of radar correlation with significant ice depolarization events accompanied by low copolarization fades of the 28.56 CHz COMSTAR beacon signal are described. The copol and cross polarization levels of the 28.56 GHz beacon signal were sequentially monitored. A nearby high resolution S band radar pointing along the Earth satellite path monitored the simultaneous ice and rain reflectivity. For the first case, excellent correlation is noted between the cross polarization events and relatively large and extended ice reflectivities along a segment of the Earth satellite path at altitudes near and above the 0 C isotherm. In the second case, the radar and receiver data strongly suggest the cross polarization mechanism is due to a hailshaft which intersects the path at altitudes well below the 0 C isotherm. Extracted depolarization signals were statistically characterized for the 1979 data base in terms of a cumulative distribution as well as monthly and time of day statistics under the given condition that the copol fade is less than 2 dB. B.W.

**N82-14549*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**A SIMULATION STUDY OF THE RECESSION COEFFICIENT FOR ANTECEDENT PRECIPITATION INDEX**

Bhaskar J. Choudhury and Bruce J. Blanchard Nov. 1981 25 p refs Submitted for publication

(NASA-TM-83860) Avail: NTIS HC A02/MF A01 CSCL 08M

The antecedent precipitation index (API) is a useful indicator of soil moisture conditions for watershed runoff calculations and recent attempts to correlate this index with spaceborne microwave observations have been fairly successful. It is shown that the prognostic equation for soil moisture used in some of the atmospheric general circulation models together with Thornthwaite-Mather parameterization of actual evapotranspiration leads to API equations. The recession coefficient for API is found to depend on climatic factors through potential evapotranspiration and on soil texture through the field capacity and the permanent wilting point. Climatologial data for Wisconsin together with a recently developed model for global isolation are used to simulate the annual trend of the recession coefficient. Good quantitative agreement is shown with the observed trend at Fennimore and Colby watersheds in Wisconsin. It is suggested that API could be a unifying vocabulary for watershed and atmospheric general circulation modelars. Author

**N82-14550*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**SPECTRAL ATMOSPHERIC OBSERVATIONS AT NANTUCKET ISLAND, MAY 7-14, 1981**

T. A. Talay and L. R. Poole Nov. 1981 56 p refs

(NASA-TM-83196) Avail: NTIS HC A04/MF A01 CSCL 04A

An experiment was conducted by the National Langley Research Center to measure atmospheric optical conditions using a 10-channel solar spectral photometer system. This experiment was part of a larger series of multidisciplinary experiments performed in the area of Nantucket Shoals aimed at studying the dynamics of phytoplankton production processes. Analysis of the collected atmospheric data yield total and aerosol optical depths, transmittances, normalized sky radiance distributions, and total and sky irradiances. Results of this analysis may aid in atmospheric corrections of remote sensor data obtained by several sensors overflying the Nantucket Shoals area. Recommendations are presented concerning future experiments using the described solar photometer system and calibration and operational deficiencies uncovered during the experiment. A.R.H.

**N82-14551#** Technische Hogeschool, Delft (Netherlands). Dept. of Physics.

**WATER AERATION WITH PLUNGING JETS**

Jan vandeDonk 1981 169 p refs

(ISBN-90-6231-088-5) Avail: NTIS HC A08/MF A01

Application of plunging water jets to large scale aeration processes is studied. Entrainment measurements made with various nozzle types with diameters up to 10 centimeters are given. A hydrodynamic model in which the plunging jet is continued below the water surface in a conical form is described. The entrained air in this biphasic cone is broken up into fine bubbles. This model contains four parameters which describe: (1) the water entrainment by the jet, (2) the gas fraction of the recirculating fluid, (3) the liquid velocity at which bubbles escape from the cone and (4) the ratio between the width of the downflowing liquid velocity and gas fraction profiles. The oxygen transfer from the air bubbles into the water of the plunging jet aerator is studied as well as the influence of contaminants on the aeration constant. Two examples of practical application of the plunging water jet: an aeration basin for the treatment of waste water and a fermentor for the production of yeast are presented. These examples confirm that plunging jet aerators can achieve mass transfer efficiencies up to 2 kgO2/kWh using air in commercial scale applications. R.J.F.

**N82-14552*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**RELIABLE AERIAL THERMOGRAPHY FOR ENERGY CONSERVATION Final Report**

John R. Jack and Robert L. Bowman Aug. 1981 35 p refs Original contains color illustrations

(Contract DE-AI01-79CS-20270)

(NASA-TM-81766; DOE/NASA/20270-1; E-828) Avail: NTIS HC A03/MF A01 CSCL 08B

A method for energy conservation, the aerial thermography survey, is discussed. It locates sources of energy losses and wasteful energy management practices. An operational map is presented for clear sky conditions. The map outlines the key environmental conditions conductive to obtaining reliable aerial thermography. The map is developed from defined visual and heat loss discrimination criteria which are quantized based on flat roof heat transfer calculations. E.A.K.

**N82-14553#** European Space Agency, Paris (France).

**APPLICATION OF REMOTE SENSING DATA ON THE CONTINENTAL SHELF: PROCEEDINGS OF AN EARsL-ESA SYMPOSIUM**

N. Longdon, comp. and G. Levy, comp. Jul. 1981 298 p refs Symp. held in Voss, Norway, 19-20 May 1981 Prepared in cooperation with Royal Norwegian Council for Scientific and Industrial Research, Kjeller

(ESA-SP-167; ISSN-0379-6566) Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

A symposium which studied the application of remote sensing techniques to oceanography, fishing, pollution monitoring, and coastal zone management is reported. National programs, operational requirements, and state of the art are reviewed. The use of satellites, including LANDSAT, Seasat and ERS is highlighted. For individual titles, see N82-14554 through N82-14588.

**N82-14554#** European Space Agency, Paris (France). Directorate of Application Programmes.

**ERS-1: MISSION OBJECTIVES AND SYSTEM CONCEPT**

G. Duchossois and D. Lennertz *In its* Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 5-16 (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The objectives of the first ESA remote sensing (ERS-1) satellite program are the development and promotion of commercial applications related to a better knowledge of ocean parameters; monitoring of sea ice and icebergs for industrial oceanic activities at high latitudes; and to increase understanding of coastal zones and global ocean processes which, together with

the monitoring of the polar regions, can provide a major contribution to the World Climate Research Program. The ERS-1 system (space segment and ground segment) is described including the instruments which are part of the Earth applications payload, active microwave instrumentation, an ocean color monitor, and a radar altimeter. The procedures used in selecting the Earth sciences payload complement, the parameters which can be obtained from the applications payload, and a development plan for the ERS-1 system are outlined. Author (ESA)

**N82-14555#** European Space Agency, Paris (France).
**THE NEED FOR INTEGRATED OFF-SHORE, REAL-TIME INFORMATION AND MANAGEMENT SYSTEMS**
L. W. Morley *In its* Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 17-21 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Integrated planning, in which data from ships, aircraft, data buoys, and shore or satellite-borne radar are used for ocean surveillance is urged. The Atlantic coast of Canada is used as an example of the inefficiency of current management methods. Traffic control, search and rescue missions, pollution control, weather forecasting, and fisheries management are directed by separate government agencies, each with its own information system. A coordinated approach would reduce waste and allow full advantage to be taken of technological developments, e.g., satellites, unknown when the agencies were created.
Author (ESA)

**N82-14556#** Naval Oceanographic Office, Washington, D. C.
**THE POTENTIAL AND REQUIREMENTS FOR SPACE OCEANOGRAPHY**
Ross N. Williams *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 23-27 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The use of satellite systems for communications, navigation, weather, oceanographic, and military purposes is reviewed. The trend is towards automated measurement, analysis, forecast and display of environmental effects. Both Marisat and Fleetsatcom, the shore based naval environmental data network and the commercial satellite data distribution system solve display and dissemination problems; and large dedicated computer capacity and atmospheric prediction models solve analysis and prediction software problems. Meteorological satellite programs together with more traditional atmospheric and oceanographic data imputs is used to demonstrate that globally sensed oceanographic data to initialize the models is not yet fully available, but could be determined with improved accuracy and resolution by employing an ocean satellite system, such as NOSS. Author (ESA)

**N82-14557#** Conoco Norway, Inc., Oslo.
**OFFSHORE PETROLEUM INDUSTRY ENVIRONMENTAL DATA REQUIREMENTS: EMPHASIS ON REMOTE SENSING**
Ronald L. Gratz *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 31-43 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Data quality and coverage requirements for the remote sensing of oceanographic and meteorological factors affecting the development of offshore hydrocarbon resources are considered, using a combination of fine-grid hindcasting and surface truth measurements. The establishment of data banks able to accumulate 20-30 years of climatological data for use in future designs is recommended. Special measurement programs are planned for data collection during storms. Remote sensing was used to measure several factors important to the petroleum industry, i.e., waves, winds, currents, and sea ice. Application to weather forecasting is shown. The use of surface truth data in the calibration and verification of measurements for remote sensing is suggested. Possible communications channels for the exchange of remote sensing data are assessed. Author (ESA)

**N82-14558#** Nice Univ. (France). Lab. d'Ocenagraphie Biologique.
**REQUIREMENTS IN POLLUTION MONITORING AND COASTAL MANAGEMENT**
J. Constans (Fondation Cousteau, Monaco) and G. Leger *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 45-46 (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Results of tests during a survey of Mediterranean coasts by the research vessel Calypso show general chemical pollution to be too low to justify the rapid decrease in fish, seaweed, and phanerogam populations. However, mechanical and/or physical attacks on the environment, such as land filling and associated constructions, or massive discharges of warm effluents have a devastating impact on coastal ecosystems. Development decision are based on individual/local perspectives. An approach, based on clear, overall, long-term strategies is called for before irreversible damage is done. Optimum use should be made of existing data aquisition techniques, such as ESA and Telespazio satellite imagery. Author (ESA)

**N82-14559#** Institute of Marine Research, Bergen (Norway).
**FISHERIES INVESTIGATIONS AND MANAGEMENT BENEFITS FROM REMOTE SENSING**
R. Ljoen *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 47-54 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Physical and biological research in areas of particular interest to Norwegian fisheries is described and present problems connected with the management of cod, haddock and mackerel are indicated. Echo sounding techniques are used and salinity and water temperature at different depths are noted. The significance of ice edge dynamics, ocean fronts, and vertical stratification to biological conditions and fish distribution is surveyed. The application of remote sensing is primarily valued as a tool for providing real time physical data in order to optimize biological sampling programs and for indicating drift and variable distributions of eggs and young fish. The utility of IR and visible images from polar orbiting satellites for monitoring purposes is briefly considered. Author (ESA)

**N82-14560#** Centre National d'Etudes Spatiales, Toulouse (France).
**STATE-OF-THE-ART IN USING A SPACEBORNE ALTIMETER AND SCATTEROMETER FOR THE DETERMINATION OF WIND, SEA STATE, AND MARINE AND ICE DYNAMICS**
M. Lefebvre and J.-L. Hyacinthe (Centre National pour l'Exploitation des Oceans, Paris) *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 57-58 (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The accuracy of Seasat altimeter and scatterometer data is discussed. Sea state obtained through altimeter pulse shape and wind data obtained by altimeter pulse amplitude or, with direction by the scatterometer backscatter, are compared with model and map values. The altimeter performs well, but not the scatterometer. Altimeter data can be used to investigate marine and ice dynamics on a large scale, e.g., a sea. For seasonal and interannual fluctuation of oceanic circulation, a few cm accuracy on the relative satellite trajectory without geoid accuracy is needed. For the mean ocean circulation and the absolute determination of current, a 10 cm accurate geoid is needed. Author (ESA)

**N82-14561#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.
**THE SEASAT COMMERCIAL DEMONSTRATION PROGRAM**
S. W. McCandless (User Systems Engineering, Annandale, Va.), B. P. Miller (Econ, Inc., Princeton, N.J.), and D. R. Montgomery *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 59-72 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The background and development of the Seasat commercial demonstration program are reviewed and the Seasat spacecraft and its sensors (altimeter, wind field scatterometer, synthetic aperture radar, and scanning multichannel microwave radiometer) are described. The satellite data distribution system allows for selected sets of data, reformatted or tailored to specific needs

and geographical regions, to be available to commercial users. Products include sea level and upper atmospheric pressure, sea surface temperature, marine winds, significant wave heights, primary wave direction and period, and spectral wave data. The results of a set of retrospective case studies performed for the commercial demonstration program are described. These are in areas of application such as marine weather and ocean condition forecasting, offshore resource exploration and development, commercial fishing, and marine transportation. Author (ESA)

**N82-14562#** Copenhagen Univ. (Denmark). Inst. of Physical Oceanography.

**THE COLOR OF THE SEA AND ITS RELATION TO SURFACE CHLOROPHYLL AND DEPTH OF THE EUPHOTIC ZONE**

N. K. Hoejerslev *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 73-76 refs (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Algorithms based on signal ratios from the available channels in Nimbus 7, for the estimation of chlorophyll and phaeophytin are found to be inadequate. This is shown for coastal waters where the concentration of yellow substance (dissolved organic matter) which masks the chlorophyll signal can be variable by orders of more than 10. However, a single globally valid algorithm, based on two wavelengths in the blue and green parts of the spectrum, gives a good estimation of the depth of the euphotic zone as well as for intermediate quanta percentage levels. It is suggested that a relationship be sought involving the depth of the euphotic zone and plankton pigments, standing stock, and primary productivity. Author (ESA)

**N82-14563#** Canada Centre for Remote Sensing, Ottawa (Ontario).

**A RECOMMENDED SENSOR PACKAGE FOR THE DETECTION AND TRACKING OF OIL SPILLS**

H. H. Zwick, R. A. Neville, and R. A. ONeil *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 77-88 refs (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Oil on open water under clear skies is a relatively easy target, oil under ice is very difficult. Results of remote sensing experiments acquiring data for system specification are discussed. Instruments assessed include active microwave sensors for the measurement of backscatter from oil slicks, scanners for oil thickness determination from the spectral character of reflected radiation and solar heating effects, and laser fluorosensors for oil-specific detection in oil and water and/or ice mixtures and for Raman scattering from the surface. The most effective system for the wide variety of conditions experienced in Canada consists of a laser fluorosensor, an ultraviolet/infrared line scanner, a side-looking airborne radar, low light level television and photographic cameras. These sensors are supported by real time data annotation, display, and analysis systems. Author (ESA)

**N82-14564#** Oceanroutes, Inc., Palo Alto, Calif.

**AN EVALUATION OF SEASAT-A DATA IN RELATION TO OPTIMUM TRACK SHIP WEATHER ROUTING AND SITE SPECIFIC FORECASTING FOR THE OFFSHORE OIL INDUSTRY**

C. Daley, R. G. Johnson, and J. C. Thomson *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 93-102 refs (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The usefulness of Seasat-A SASS and altimeter measurements is reviewed. Five oceanic areas were selected: the Gulf of Alaska, central and western north Atlantic, eastern north Pacific, southern Indian Ocean, and the North Sea. Both Seasat-aided and conventional analyses were used in offshore hindcast and optimum ship routing situations. Where conventional observations are relatively dense, Seasat wind and wave data have greater impact in determining the shape of major map features than in positioning the features. In data sparse areas, Seasat data permit greater definition of surface features as well as their precise location. The use of Seasat data in optimum ship routing is quantified by means of comparative studies in the Gulf of Alaska. Author (ESA)

**N82-14565#** University Coll., Galway (Ireland).

**DETERMINATION OF SURFACE WIND SPEED FROM REMOTELY MEASURED WHITECAP COVERAGE, A FEASIBILITY ASSESSMENT**

E. C. Monahan, I. G. Muircheartaigh, and M. P. Fitzgerald *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 103-109 refs (For primary document see N82-14553 05-43)

(Grant N00014-78-G-0052)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The relationship between wind speed and oceanic whitecap coverage was determined to facilitate the development of an algorithm for the remote determination of low elevation wind speed from the teledetected enhancement of sea surface microwave brightness temperature due to the presence of whitecaps. A basis is provided for estimating (and correcting for) the contribution to radiance, coming from whitecaps, in the various visible bands measured by satellite instruments. Combining results of the JASIN experiment with earlier observations, the effect of variations in air and sea surface temperature on this relationship is investigated. The wind speed at which whitecaps appear, and thus the lowest wind speed susceptible to teledetection via whiecap signature, is reassessed. Author (ESA)

**N82-14566*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**THE NORWEGIAN REMOTE SENSING EXPERIMENT (NORSEX) IN A MARGINAL ICE ZONE**

B. Farrelly (Bergen Univ.), J. Johannessen (Bergen Univ.), O. M. Johannessen (Bergen Univ.), E. Svendson (Bergen Univ.), K. Kloster (C. Michelson Inst.), I. Horjen (Norwegian Hydrodynamic Labs.), W. J. Campbell (Geological Survey, Tacoma, Wash.), J. Crawford, R. Harrington, L. Jones et al *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 113-118 refs Sponsored in cooperation with NASA Bergen Univ., and Royal Norwegian Council for Scientific and Industrial Research (For primary document see N82-14553 05-43)

(Grants N00014-80-G-0003; NATO-9-4-02-SRG.19)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125 CSCL 17I

Passive and active microwave measurements from surface based, airborne, and satellite instruments were obtained together with surface observations northwest of Svalbard. Emissivities of different ice patches in the ice edge region over the spectral range from 4.9 to 94 GHz are presented. The combination of a 6.6 GHz microwave radiometer with a 14.6 GHz scatterometer demonstrates the usefulness of an active/passive system in ice classification. A variety of mesoscale features under different meteorological conditions is revealed by a 1.36 GHz synthetic aperture radar. Ice edge location by Nimbus 7 scanning multifrequency microwave radiometer is shown accurate to 10 km when the 37 GHz horizontal polarized channel is used.

Author (ESA)

**N82-14567#** Institute of Oceanographic Sciences, Wormley (England).

**A PRELIMINARY EVALUATION OF SEASAT PERFORMANCE OVER THE AREA OF JASIN AND ITS RELEVANCE TO ERS-1**

T. D. Allan and T. H. Guymer *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 119-127 refs (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The microwave sensor data of Seasat was checked using Joint Air-Sea Interaction Experiment surface observations. The results of passes under light, and moderate to strong winds, show that sea surface conditions are revealed more accurately by Seasat than by weather charts based on ship reports. Wind observations are similar for satellite and surface observers.

Author (ESA)

**N82-14568#** Centre National d'Etudes Spatiales, Paris (France).

**SPOT DATA SIMULATIONS: LITTORAL APPLICATIONS**

N. Lannelongue *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 129-130 (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Remote sensing SPOT imagery was simulated. User plans for taking advantage of the data are elaborated and the adequacy

of SPOT specifications is assessed. Since actual satellite data are not available, a set of aerial remote sensing images with a photographic camera and multispectral scanner was used. The Loire estuary is being studied. Data in the visible and near infrared, of high resolution and good accessibility, are being collected. Simulations show that images can be used immediately after launch. Author (ESA)

**N82-14569#** National Inst. of Oceanography, Goa (India).
**STUDIES OF THE INDIAN CONTINENTAL SHELF: APPLICATION OF REMOTE SENSING DATA**
L. V. GangadharaRao and V. R. Rao (Indian Space Research Organization, Bangalore) *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 131-141 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Early studies of coastal areas of India are reviewed and the state of the art of current studies is presented, including the identification of possible applications of remote sensing data in the context of ongoing programs and future study needs. Multidisciplinary studies with the Indian oceanographic research vessel RV Gaveshani are considered. Ocean engineering and coastal zone management (with application to offshore drilling and harbor development, fisheries, and pollution monitoring are discussed. Remote sensing data from satellites can contribute significantly to this program. Author (ESA)

**N82-14570#** Centre d'Etudes de Meteorologie Spatiale, Lannion (France). Antenne ORSTOM.
**A SHORT REVIEW OF AN OCEANOGRAPHIC USE OF METEOSAT DATA BY THE ORSTOM REMOTE SENSING SERVICE**
J. Citeau and F. Domain (Centre Oceanologique de Bretagne, France) *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 145-156 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Using the thermal infrared band, migration of schools of fish along coasts of Mauritania and Senegal was determined according to the latidudinal position of a thermal front and equatorial upwelling in the Gulf of Guinea was detected. For the latter study, an oceanographic program was instigated to furnish sea truth data. Despite a high degree of cloud cover, the Meteosat data shows good agreement on sea surface temperature. The beginning and development of the equatorial upwelling are adequately followed. The zonal extension of a large warm water band confirms that this upwelling is a phenomenon related to the equatorial process and that no advection from southern latitudes appears on the surface. Author (ESA)

**N82-14571#** Dundee Univ. (Scotland). Carnegie Lab. of Physics.
**COASTAL ZONE RESEARCH USING REMOTE SENSING TECHNIQUES**
A. P. Cracknell and S. M. Singh *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 157-168 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

For the prelaunch exercise in connection with the EURASEP project, sea truth data was analyzed with data collected simultaneously from LANDSAT. Maps of chlorophyll and suspended sediment distributions over a substantial area of the North Sea off the Belgian and Dutch coastlines were generated. Analysis results of simultaneous airborne ocean color scanner data are compared. The NIMBUS 7 coastal zone color scanner (CZCS) in flight calibration data are compared with preflight calibration constants. Atmospheric corrections are applied. A satisfactory set of procedures for calibrating CZCS data, correlating that data with sea truth measurements, were established. Author (ESA)

**N82-14572#** Ecole Nationale Superieure des Mines, Sophia-Antipolis (France). Centre de Teledetection et d'Analyse des Milieux Naturels.
**OIL SPILLS: LARGE SCALE MONITORING BY LANDSAT**
M. Albuisson, J. M. Monget, and L. Wald *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 171-172 refs Sponsored by Joint Research Center of the European Communities (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Oil pollution at sea using the LANDSAT multispectral scanner channel was detected. The variations of the reflection coefficient between rough sea and the oil spill was measured. The oil spill flattens the sea and reflects in only one direction while the capillary waves of rough sea scatter the light; a fraction of the incident light only reaches the satellite. An underestimate of pollution is expected during winter because of low solar elevation angles. This method is used to inventory pollution by hydrocarbons in the Mediterranean Sea. An estimation from 800 images shows the cumulative area covered by hydrocarbons, spread over the Mediterranean Sea each year, as 175,000 sq km. Author (ESA)

**N82-14573#** Ministere de l'Environment et du Cadre de Vie, Neuilly (France). Direction de la Prevention des Pollutions.
**THE OPERATIONAL OIL POLLUTION SURVEILLANCE SYSTEM BEING USED IN FRANCE: FORECASTED FUTURE DEVELOPMENTS IN CONSIDERATION OF THE NATO/CCMS REMOTE SENSING PILOT STUDY CONCLUSIONS**
J. M. Massin *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 173-180 ref (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The requirements of an ideal system for detecting, identifying, classifying, mapping, and tracking oil spills are defined. A core package consisting of a human observer, photographic cameras, side-looking airborne radar, infrared/ultraviolet line scanner, and passive television is proposed. The French airborne remote sensing system is shown to satisfy these requirements. Problems with a remote sensing system able to operate under all weather conditions, transmitting specific information in real time which permits the identification of hydrocarbons without having to check in situ, are discussed. Satellite possibilities are estimated. Author (ESA)

**N82-14574#** Centre d'Etudes Techniques de l'Equipment, Aix-en-Provence (France).
**OPERATIONAL USE OF REMOTE SENSING FOR COASTAL ZONE MANAGEMENT AND POSSIBLE CONTRIBUTION OF SPECIALIZED SATELLITES**
C. Valerio *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 183-188 (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

A multispectral remote sensing system, based on aerial photography, was developed in order to satisfy the requirements of coastal zone management. Data requirements (hydrodynamics, nature of the sea bottom, shore and land use) are interpreted in remote sensing terms. Technoeconomic results for study of the sewage treatment in Antibes on the Mediterranean coast are taken as a remote sensing example. Surface currents were investigated under different wind and climatic conditions. Vertical temperature and salinity profiles show vertical thermal stratification of the sea in that area. Author (ESA)

**N82-14575#** Canada Centre for Remote Sensing, Ottawa (Ontario).
**RECENT WORK IN PASSIVE OPTICAL IMAGING OF WATER**
H. H. Zwick and S. C. Jain (Moniteq Ltd.) *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 189-194 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The estimation of water quality and bathymetry with passive optical multispectral data imagery are described. A water quality algorithm was developed from a coordinated set of airborne, multispectral scanner, in situ water, and ground based atmospheric measurements made during coastal zone color scanner NIMBUS 7 passes over Lake Ontario. Modeling of atmosphere, the air water interface, and macroscopic as well as microscopic water optical characteristics gives fresh water estimates of the independently varying chlorophyll-a and total suspended mineral concentrations. Remotely measured radiances are corrected for atmosphere, specular sky reflection, and water refractivity in

effects. The required parameters are estimated using a computer optimization routine. Author (ESA)

**N82-14576#** Swedish Meteorological and Hydrological Inst., Norkoeping.
**MARINE ACTIVITIES IN SWEDEN FOR WHICH REMOTE SENSING DATA MAY BE OF INTEREST**
Thomas Thompson *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 195-196 (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Coastal and offshore activities (physical oceanography, marine meteorology, fishing, marine transportation, environmental protection, and climatology) for which satellite data, particularly microwave measurements available on an operational basis is useful, were reviewed. These involve weather analyses and forecasting, ship routing, ice accretion measurement, sea ice surveillance, sea surface temperature measurement, wave analyses and forecasts, pollution surveillance, sea water level measurement, and surface currents monitoring. Present data has many deficiencies which can be remedied by remote sensing techniques, but a fully operational system is required. Author (ESA)

**N82-14577#** Belfotop P.v.b.a., Wemmel (Belgium).
**AIRBORNE REMOTE SENSING OF THE COASTAL ZONE**
J. L. vanGenderen and G. DeMan *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 197-202 (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Using the European remote sensing aircraft platform, equipped with a digital multispectral scanner, two metric cameras, a realtime imaging system, and a digital navigation system, coastal zones were studied. The airborne platform and its operation are described. Practical problems associated with coastal airborne remote sensing are discussed (position fixing over water; day-night imaging; film processing; digital multispectral data processing) and examples from oil pollution monitoring, thermal discharge studies, coastal erosion, and surface wave direction analysis are given.
Author (ESA)

**N82-14578#** Consiglio Nazionale delle Ricerche, Venice (Italy).
**MULTITEMPORAL CALIBRATION OF LANDSAT IMAGES: A METHOD FOR IMPROVING THE MARINE PHENOMENA RECOGNITION, WITH AS EXAMPLE THE VENICE LAGOON**
L. Alberotanza and A. Zandonella (Telespazio S.p.a.) *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 205-209 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

A method for LANDSAT data multitemporal calibration, developed during work on pollution diffusion in the Venice lagoon, was examined. The method consists of a projection, onto a like signal feature space, of images recorded in different time periods, with the aim of enhancing and analyzing the common features. An application in marine phenomena recognition (discrimination between water brightness image and haze image) is discussed together with the results. Author (ESA)

**N82-14579#** Roskilde Univ. (Denmark). Institute of Geography, Socio-Economic Analysis and Computer Science.
**MAPPING OF SURFACE CURRENTS IN GREENLAND FIORDS BY MEANS OF LANDSAT IMAGES**
Sten Folving *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 211-219 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Data from LANDSAT were used to study the propagation of meltwater into Soendre Stroemfjord. Water masses are classified on the basis of intensity profiles. These data trace meltwater sediment plumes and the character of the fronts between meltwater and pure fiord water. The main currents are mapped. River discharge from the south side is always up fiord due to pronounced Coriolis influence. A permanent down fiord current is found on the north side, with very complex patterns of current arising when the direction of the fiord channel shifts significantly. Author (ESA)

**N82-14580#** Southampton Univ. (England).
**THE USE OF LANDSAT MSS TO OBSERVE SEDIMENT DISTRIBUTION AND MOVEMENT IN THE SOLENT COASTAL AREA**
I. S. Robinson and D. Srisaengthong *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 221-232 refs Sponsored by UK Dept. of Industry (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The LANDSAT multispectral data from the Solent area was used to explore the potential value to marine scientists of archived data on estuaries and coastal regions. Ten images from the archives were digitally enhanced by color slicing, yielding useful qualitative information when interpreted as suspended sediment. Two further clear weather images were obtained. An approximate calibration algorithm based on six archives band-5 images and non coincident field observations show good agreement with a synoptic calibration of the last two images. The calibrated archived images show similar seasonal variations to those observed. The possibility, for certain estuaries, of obtaining quantitive information from archived data, using only recent field observations, is suggested. Author (ESA)

**N82-14581#** University Coll., Galway (Ireland).
**THE FEASIBILITY OF USING REMOTELY SENSED COLOR AS AN INDEX OF IRISH COASTAL WATER PROPERTIES**
E. C. Monahan, I. G. OMuircheartaigh, and M. P. Fitzgerald *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 233-237 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Sea truth data collected at 250 oceanographic stations in coastal waters south and west of Ireland are used with statistical methodologies (including least squares fitting and the approach of Box and Cox) to obtain, where feasible, expressions for the relationships between water color and other surface water properties. Close correlation is found between surface salinity, Gelbstoff concentration and water color as expressed by Munsell hue. For the same waters, poor correlation is found between surface chlorophyll-a and water color. Such satellite instruments as the coastal zone color scanner are applicable to the delineation of coastal and offshore water boundaries near Ireland, but are not appropriate for estimating the standing crop of phytoplankton. Author (ESA)

**N82-14582#** Instituto de Investigaciones Pesqueras, Barcelona (Spain).
**NECESSITY OF REMOTE SENSING FOR OCEAN STUDIES. PART 1: NORTHWEST AFRICAN MISSIONS, SAHARA-1 AND ATLOR-1**
A. Ballester Nolla and C. Romeu Nedwed *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 239-241 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Results of two oceanographic missions studying the general conditions of the northwest African offshore upwelling are summarized. Strong correlation between temperature, nutrients (nitrate, phosphate, and silicate) and chlorophyll is found. The upwelling area, 60 to 100 miles offshore, does not correspond to normally accepted mechanisms. Preliminary results suggest a collision between intermediate subequatorial water masses and the southward surface Canary current. The hypothesis is supported by tests comparing sea truth data with remotely sensed temperature data (NOAA 2 VHRR). The employment of remotely sensed data as a formal method of study, and not simply as a complementary aid, is discussed. Author (ESA)

**N82-14583#** Bergen Univ. (Norway). Dept. of Chemistry.
**OIL SPILL IDENTIFICATION BY CHEMICAL ANALYSIS**
O. Grahl-Nielsen and S. Wilhelmsen (Inst. of Marine Research, Bergen) *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 243-244 refs (For primary document see N82-14553 05-43)
Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Gas chromatographic analyses of the relative amounts of phenanthrene and dibenzothiophene and their alkylated derivatives are shown to distinguish crude oils from different parts of the world and crude oils from different fields in the North Sea Ekofisk

area. These aromatic hydrocarbons are relatively unaffected by weathering and can be used for matching oils from oil spills with unweathered samples from the suspected source. The method was used to identify the source of an oil spill in Bergen harbor. It is shown that analysis of the relative amounts of dibenzothiophenes is sufficient to discriminate between crude oils in most cases. Author (ESA)

**N82-14584#** Norwegian Defence Research Establishment, Kjeller.

**SEASAT SAR PROCESSING AT THE NORWEGIAN DEFENCE RESEARCH ESTABLISHMENT**

E. A. Herland *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 247-253 refs (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

A digital processor which processes synthetic aperture radar (SAR) images from raw data gathered by a satellite platform is described. The basic principles of SAR are explained; the algorithms for the digital processor are given in terms of a block diagram, the different parts of which are considered separately. A routine for achieving automatic focusing in azimuth compression without satellite orbit information is discussed. Examples of imagery obtained by applying the algorithms to raw data from the Seasat-1 SAR system are shown. These indicate that it is possible to detect ships and that the system can be used for maritime surveillance purposes. Author (ESA)

**N82-14585#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronik.

**MARITIME APPLICATIONS OF IMAGE PROCESSING AT DFVLR, OBERPFAFFENHOFEN, WEST GERMANY**

Klaus A. Ulbricht *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 255-261 refs (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

A digital interactive image analysis system is described and plans for a larger system are summarized. Examples of digital image processing of LANDSAT multispectral scanner images, showing contents otherwise easily missed, are given. Zones of different reflectivity, representing currents or drifts, are pointed out. The LANDSAT pictures of the Baltic Sea from four multispectral channels, processed to display the mass appearance of blue green algae, are included. Phytoplankton development in nearshore and inshore waters of the southwest Baltic, and its drift to deeper areas, are followed. Complexes of banks and channels revealed by LANDSAT in the Tay river and its delta in northeast Scotland are compared with current charts and maps of sediments. Author (ESA)

**N82-14586#** Atomic Energy Research Establishment, Harwell (England). Marine Technology Support Unit.

**A LOOK AT NONSATELLITE REMOTE SENSING SYSTEMS FOR MARINE USE**

R. J. Moulton *In* ESA Appl. of Remote Sensing Data of the Continental Shelf Jul. 1981 p 263-271 refs Sponsored by UK Dept. of Industry (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Cost/benefit figures are given (but in some cases the costs are distorted by military investment). The main applications of remote sensing are fish location, pollution monitoring, shallow water bathymetry, and sea state measurement (with its implications for optimum ship routing). User needs for a system are classified by choice of function, operational choices, technical decisions, relevant sensors, and sensing techniques (H.F.; radar; u.v.; fluorimetry; pulsed laser bathymetry; low light television; cameras; passive multifrequency microwave imaging. The U.S. oil surveillance system as well as Swedish and French systems are described. Nonsatellite systems can be best used to verify satellite data. Author (ESA)

**N82-14587#** Indian Space Research Organization, Bangalore.

**SCIENTIFIC STUDIES USING BHASKARA SATELLITE MICROWAVE RADIOMETER (SAMIR) DATA: A SHORT OVERVIEW**

V. R. Rao IN ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 273-278 refs (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

The three-channel microwave radiometric system SAMIR (two frequencies at 19 GHz and one at 22 Ghz) which is one of the two payloads on board the Bhaskara satellite, is described; along with the satellite itself and its complete payload. Data quality and methods of analysis are reviewed and the use of the data for investigation of sea states, water vapor and liquid water content in the atmosphere and over oceans adjoining India is examined. The derivation of these and further ocean related parameters (sea surface winds; rainfall rates) for monitoring sea state conditions in India was demonstrated. Author (ESA)

**N82-14588#** Norwegian Air Survey Co., Oslo.

**USE OF SIDE LOOKING AIRBORNE RADAR (SLAR) FOR OIL POLLUTION MONITORING IN NORWAY**

Svein Erik Hoest *In* ESA Appl. of Remote Sensing Data on the Continental Shelf Jul. 1981 p 281-282 ref (For primary document see N82-14553 05-43)

Avail: NTIS HC A13/MF A01; ESA, Paris FF 125

Integration of the system with a data annotation unit and a navigation system is outlined. Position data, date, time, and mission parameters are annotated on film. Data are also displayed on a TV monitor while the radar image and data can be recorded on an onboard video cassette recorder. The installation of the system and its operation are covered and its potential use in oil spill monitoring (particularly at night and in low visibility) is explained. Other possible uses are summarized (search and rescue missions, geology, oceanography) together with possible future extensions of the sensor package and survey aircraft.

Author (ESA)

**N82-14589#** Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

**THE EFFECT OF SPATIAL VARIABILITY IN PRECIPITATION ON STREAMFLOW**

Keith J. Beven and George M. Hornberger Sep. 1981 40 p refs Submitted for publication Prepared in cooperation with Illinois State Water Survey, Urbana

(Contract DAAG29-80-K-0053; Grant NSF ATM-78-08865)

(AD-A105955; TR-6; ARO-16816.3-GS) Avail: NTIS HC A03/MF A01 CSCL 04/2

In most approaches to modelling the rainfall/runoff process, a spatially lumped description of precipitation has been assumed adequate for modelling the important aspects of catchment response. However, theories of catchment hydrology as well as some recent modelling studies suggest that spatial variability in precipitation may be important in determining the characteristics of streamflow hydrographs. Data from two intensive rainfall recording experiments in Illinois have been used to examine the effects of rainfall pattern on stream hydrographs for summer convective storms. A threshold analysis was used to distinguish storms of markedly different pattern. A mixed deterministic/stochastic modelling procedure was used to determine the length of record required to differentiate the hydrograph characteristics resulting from storms of different patterns. It was found that differences in peak timing were highly significant but that differences in the distributions of peak flow and stormflow volumes were generally insignificant even given a long period of record.

Author (GRA)

**N82-14590#** Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

**SENSITIVITY ANALYSIS OF A MESOSCALE MOISTURE MODEL Final Report**

James L. Cogan Mar. 1981 53 p refs

(DA Proj. 1L1-61102-B-53A)

(AD-A101528; ERADCOM/ASL-TR-0079) Avail: NTIS HC A04/MF A01 CSCL 04/1

Results from the model were computed for a variety of atmospheres and terrain types. A limited sensitivity analysis showed the effect of different model input parameters on meteorological variables for one vertical column through the atmosphere at a central horizontal grid point. A detailed analysis of selected cases for the entire domain of the model indicated the effect of input parameters on vertical velocity, precipitation amount, and precipitation rate. For one set of input parameters,

analyses were performed of the variation of vertical velocity and precipitation every 2 hours for a 12-hour period. An example of a potential application to electro-optical algorithms is discussed and suggestions are made for future work. T.M.

**N82-14591#** Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
**SATELLITE OBSERVATIONS OF THE MT. ST. HELENS' ERUPTION OF 18 MAY 1980**
Carl J. Rice 21 Aug. 1981 32 p refs
(Contract F04701-80-C-0081)
(AD-A105784; TR-0081(6640)-3; SD-TR-81-70) Avail: NTIS HC A03/MF A01 CSCL 08/7

The explosive eruption of Mt. St. Helens on 18 May 1980 was monitored by infrared sensors aboard two U.S. Air Force satellites. Essentially continuous data are available following the initial sighting of the eruption cloud less than one minute after the earthquake which triggered the eruption. Dual monitoring permits triangulation so that both the horizontal and vertical development of the eruption can be determined with good temporal resolution. The sequence of events occurring early in the eruption can therefore be established. Author (GRA)

**N82-14592#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**MEASUREMENTS OF RADAR BACKSCATTER FROM ARCTIC SEA ICE IN THE SUMMER**
R. G. Onstott, S. Gogineni, C. V. Delker, and R. K. Moore Jul. 1981 16 p
(Contract N00014-76-C-1105)
(AD-A105586; CRINC/RSL-TR-331-20) Avail: NTIS HC A02/MF A01 CSCL 17/9

Measurements of radar backscatter from sea ice located near Svalbarb and Greenland were made during the summer of 1980 as part of Project YMER. These data were acquired using the University of Kansas helicopter-borne microwave active spectrometer (HELOSCAT II) which operated over a frequency range of 8 to 18 GHz and an angle of incidence range of 0 degrees to 50 degrees. The presence of meltponds, the transformation of the snowpack into an ice layer, and the warmer temperatures have contributed to radar signatures that may be significantly different than those observed during the winter and spring. A wide variety of ice conditions were investigated. These included multiyear, thick first-year, thin first-year, young, new, and pressure-ridged ice. The measurement program is described herein. Author (GRA)

**N82-14593#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**MEASUREMENTS OF RADAR BACKSCATTER FROM ARCTIC SEA ICE IN THE SUMMER, APPENDICES A AND B**
R. G. Onstott, S. Gogineni, R. K. Moore, and C. V. Delker Jul. 1981 96 p
(Contract N00014-76-C-1105)
(AD-A105736; CRINC/RSL-TR-331-22) Avail: NTIS HC A05/MF A01 CSCL 17/9

Computer output measurements of radar backscatter from arctic sea ice in the summer are presented, including raw radar backscatter data and sea ice salinity profiles N.W.

**N82-14594#** Department of Energy, Laramie, Wyo.
**BIBLIOGRAPHY OF PUBLICATIONS DEALING WITH TAR SANDS**
Sep. 1981 296 p
(DE81-026146; DOE/LETC/RI-81/2) Avail: NTIS HC A13/MF A01

A compilation of technical reports, patents, journal articles and books on the development of tar sands (oil sands). The emphasis is on the US resource and its development. Included are articles on nondomestic tar sand and related heavy oil resources and their development. The subjects include: geology and resource evaluation; chemical and physical properties; in situ recovery; upgrading and refining; history; environmental; and miscellaneous (includes general survey papers; resource development, health and safety, economics, etc.). DOE

**N82-14595#** Tetra Tech, Inc., Columbus, Ohio.
**EVALUATION OF DEVONIAN SHALE POTENTIAL IN EASTERN KENTUCKY/TENNESSEE**
1981 104 p refs
(Contract DE-AC21-79MC-10389)
(DE82-001164; DOE/METC-121) Avail: NTIS HC A06/MF A01

The US Department of Energy's Eastern Gas Shales Project is designed not only to identify the resource, but also to test improved methods of inducing permeability to facilitate gas drainage, collection, and production. Results as they pertain to the Devonian gas shales of the Appalachian basin in eastern Kentucky and Tennessee are presented. Geologic data and interpretations are summarized, and areas where the accumulation of gas may be large enough to justify commercial production are outlined. DOE

**N82-14596#** Tetra Tech, Inc., Columbus, Ohio.
**EVALUATION OF THE EASTERN GAS SHALES IN PENNSYLVANIA**
1981 103 p refs
(Contract DE-AC21-79MC-10389)
(DE82-001165; DOE/METC-119) Avail: NTIS HC A06/MF A01

Areas in Pennsylvania where the accumulation of gas may be large enough to justify commercial production are outlined. Methods of inducing permeability to facilitate gas drainage, collection, and production are considered. DOE

**N82-14597#** Tetra Tech, Inc., Columbus, Ohio.
**EVALUATION OF DEVONIAN SHALE POTENTIAL IN NEW YORK**
1981 70 p refs
(Contract DE-AC21-79MC-10389)
(DE82-001163; DOE/METC-118) Avail: NTIS HC A04/MF A01

A overview of preliminary geologic interpretations developed from the Eastern Gas Shales Project (EGSP) and related data concerning the deposition of the black shale facies and generation of natural gas in the Devonian shale sequence is presented. In New York, historical stratigraphic as well as current EGSP work established the Devonian clastic facies as the type section for eastern North America. Since the initial documented shale gas well was drilled in 1821 near Fredonia, New York, numerous shale gas wells and/or deeper wells with gas shows in the shale section have been reported in western and central New York. Organic rich, black shale facies were documented and defined to project potential favorable trends. DOE

**N82-14598#** Rockwell International Corp., Canoga Park, Calif. Energy Systems Group.
**PASCO BASIN HYDROMETEOROLOGICAL STUDY**
P. J. Gutknecht, W. A. Rice, C. R. Cole, and M. D. Freshley Apr. 1980 258 p refs Prepared in cooperation with Pacific Northwest Lab., Richland, Wash.
(Contract DE-AC06-77RL-01030)
(DE82-000283; RHO-BWI-C-98; PNL-3855) Avail: NTIS HC A12/MF A01

Precipitation and evapotranspiration distributions for the Pasco Basin for use in groundwater recharge calculations are shown on maps. The parameters, calculation methods, sensitivity determinations, and fitting methods used in the development of these maps are discussed. DOE

**N82-14599#** Carson Helicopters, Inc., Perkasie, Pa. Geoscience Div.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK. VOLUME 1: DATA ACQUISITION, REDUCTION AND INTERPRETATION Final Report**
Aug. 1981 273 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000650; GJBX-327-81-Vol-1) Avail: NTIS HC A12/MF A01

A rotary wing high sensitivity radiometric and magnetic survey of the State of Maine and of Binghamton, Ogdensubrg and Utica in New York State was performed. The survey was flown with a Sikorsky S58T helicopter equipped with a high sensitivity

calibrated gamma ray spectrometer. The radiometric data were processed to compensate for Compton scattering effects and altitude ariations. The data were normalized to 400 feet terrain clearance. The reduced data are presented in the form of stacked profiles, standard deviation anomaly plots, histogram plots and microfiche listings. DOE

**N82-14600#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jul. 1981 124 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000781; GJBX-327-81-Vol-2-SHERBROOKE) Avail: NTIS HC A06/MF A01

Contents includes: the flight line base map, anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), total count map, magnetic field map, uranium map, thorium map, potassium map, ratio maps for uranium/thorium, uranium/potassium, thorium/potassium, radiometric multiple-parameter stacked profiles, magnetic and ancillary stacked profile data, and histograms. DOE

**N82-14601#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jul. 1981 140 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000401; GJBX-327-81-Vol-2-OGDENSBURG) Avail: NTIS HC A07/MF A01

Content includes: the flight line base map anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), total count map, magnetic field map, uranium map, thorium map, potassium map, ratio maps for uranium/thorium, uranium/potassium, thorium/potassium, radiometric multiple-parameter stacked profiles, magnetic and ancillary stacked profile data, and historgrams. DOE

**N82-14602#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jun. 1981 168 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000780; GJBX-327-81-Vol-2-MILLINOCKET) Avail: NTIS HC A08/MF A01

Content contains: the flight line base map, anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), total count map, potassium map, ratio maps for uranium/thorium, uranium/potassium, thorium/potassium, rdiometric multiple-parameter stacked profiles, magnetic and ancillary stacked profile data, and histograms.DOE

**N82-14603#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jul. 1981 80 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000872; GJBX-327-81-Vol-2-LEWISTON) Avail: NTIS HC A05/MF A01

Content contains: the flight line base map, anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), total count map, magnetic field map, uranium map, thorium map, potassium map, ratio maps for U/T, U/K, T/K, radiometric multiple-parameter stacked profiles, magnetic and ancillary stacked profile data, and histograms.DOE

**N82-14604#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jun. 1981 306 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000772; GJBX-327-81-Vol-2-FREDERICTON) Avail: NTIS HC A14/MF A01

Content contains: the flight path maps, anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), radiometric multiple parameter stacked profiles, magnetic and ancillary stacked profile data, histograms, total count maps, magnetic field maps, uranium maps, thorium maps, potassium maps, ratio maps for U/T, U/K, and T/K. DOE

**N82-14605#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jun. 1981 242 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000785; GJBX-327-81-Vol-2-EDMUNDSTON) Avail: NTIS HC A11/MF A01

Content contains: the flight line base maps, nomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), radiometric multiple parameter stacked profiles, magnetic and ancillary stacked profile data, histograms, total count maps, magnetic field maps, uranium maps, thorium maps, potassium maps, ratio maps for U/T, U/K, and T/K. DOE

**N82-14606#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jul. 1981 150 p refs
(Contract DE-AC13-76GT-01664)
(DE82-000869; GJBX-327-81-Vol-2-BINGHAMTON) Avail: NTIS HC A07/MF A01

Content contains: the flight line base map, anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), total count map, magnetic field map, uranium map, thorium map, potassium map, ratio maps for U/T, U/K, T/K, radiometric multiple parameter stacked profiles, magnetic and ancillary stacked profile data, and histograms.DOE

**N82-14607#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jul. 1981 260 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000794; GJBX-327-81-Vol-2-BANGOR) Avail: NTIS HC A12/MF A01

Content contains: the flight line base maps, anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), total count maps, magnetic field maps, uranium maps, thorium maps, potassium maps, ratio maps for U/T, U/K, T/K, radiometric multiple parameter stacked profiles, magnetic and ancillary stacked profile data, and histograms.DOE

**N82-14608#** Carson Helicopters, Inc., Perkasie, Pa.
**NURE AERIAL GAMMA-RAY AND MAGNETIC RECONNAISSANCE SURVEY OF MAINE AND PORTIONS OF NEW YORK, VOLUME 2 Final Report**
Jul. 1981 166 p refs
(Contract DE-AC13-76GJ-01664)
(DE82-000784; GJBX-327-81-Vol-2-UTICA) Avail: NTIS HC A08/MF A01

Content contains: the flight line base map, anomaly maps (uranium, thorium, potassium, uranium/thorium, uranium/potassium, thorium/potassium), radiometric multiple parameter stacked profiles, magnetic and ancillary stacked profile data, histograms, total count map, magnetic field map, uranium map, thorium map, potassium map, ratio maps for U/T, U/K, and T/K. DOE

**N82-14609#** Battelle Pacific Northwest Labs., Richland, Wash.
**DEALING WITH REGIONAL HYDROLOGIC DATA-BASE LIMITATIONS. CASE EXAMPLE: THE COLUMBIA RIVER BASALTS**
R. Schalla and L. S. Leonhart (Rockwell-Hanford Operations, Richland, Wash.) 1981 15 p refs Presented at the Symp. on Uncertainties Assoc. with the Regulation of the Geol. Disposal of High-Level Radioact. Waste, Gatlinburg, Tenn., 9 Mar. 1981
(Contract DE-AC06-76RL-01830)

(DE81-030086; PNL-SA-9094; CONF-810372-12) Avail: NTIS HC A02/MF A01

Limitations encountered in assembling hydrologic data for a broad geographic region, into a conceptual model of the hydrologic system may become resonant in subsequent numerical simulations of hydrologic system behavior. Such data limitations include irregular spatial distributions of data, decreases in information with increasing depth from the land surface, uncertainties about the reliability of reported hydrologic data, disparities in time dependent parameters, and lack of field verification of data. The case example of preparing a hydrologic system description for the Columbia Plateau, as required for repository siting, illustrates methods of determining the accuracy of certain data, compensating for data limitations, evaluating the need for acquiring additional data, and refining data through iterative techniques. Emphasis is placed on professional subjectivity, which has proven to be essential in data base evaluation and refinement. DOE

**N82-14610#** Oak Ridge Gaseous Diffusion Plant, Tenn.
**HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE BASIC DATA FOR BROKEN BOW NTMS QUADRANGLE, NEBRASKA**
30 Jun. 1981 206 p refs
(Contract W-6405-eng-26)
(DE81-030295; GJBX-274-81; K/UR-154) Avail: NTIS HC A10/MF A01

Statistical data and areal distributions for uranium and uranium related variables are presented for 578 groundwater and 442 stream sediment samples. Groundwater data indicate that uranium concentrations above the 85th percentile occur primarily in the southeastern and central portion of the quadrangle. Water containing high concentrations of uranium are predominantly in the Pliocene Ogallala Formation and are also found in waters derived from the Niobrara Chalk and alluvial deposits. High uranium concentrations are associated with high values of specific conductance, boron, calcium, potassium, lithium, magnesium, sodium, strontium, and total alkalinity. Uranium concentrations above the 85th percentile occur in randomly scattered sediments, with no apparent trends visible. Sediments with high uranium value are derived primarily from glacial and alluvial deposits. Sediments with high U-FL values are associated with high values of chromium, lithium, iron, magnesium, scandium, yttrium, and zirconium. Sediments with high U-NT values are generally associated with high values of cerium, titanium, and zirconium. DOE

**N82-14611#** Oak Ridge Gaseous Diffusion Plant, Tenn.
**HYDROGEOCHEMICAL AND STREAM SEDIMENT RECONNAISSANCE BASIC DATA FOR MILBANK NTMS QUADRANGLE, MINNESOTA; NORTH DAKOTA; SOUTH DAKOTA**
15 Jun. 1981 258 p refs
(Contract W-7405-eng-26)
(DE81-029657; GJBX-271-81; K-UR-156) Avail: NTIS HC A12/MF A01

Results of a geochemical survey are reported for the Milbank Quadrangle, Minnesota; North Dakota; South Dakota. Statistical data and areal distributions for uranium and uranium related variables are presented for 662 groundwater and 319 stream sediment samples. The location and geologic setting are also described. DOE

**N82-14612#** Department of Energy, Pittsburgh, Pa. Mining Technology Center.
**LONGWALL MINING OF THIN SEAMS**
Ernest A. Curth 1981 22 p refs Presented at the 1st Ann. Conf. on Ground Control in Mining, Morgantown, W. Va., 27 Jul. 1981
(DE81-028042; CONF-810714-2) Avail: NTIS HC A02/MF A01

Thin seam operations pose a challenge to the ingenuity of mining engineers to overcome the factor of human inconvenience in the restricted environment and associated high cost production. Suprisingly, low seam longwalls in the Federal Republic of Germany in an average thickness of 35 in. and dipping less than 18 deg come close to achieving the average production rate of all German longwall operations. They are all plow faces, and a consistent production of 3300 tons per day and a productivity of 40 tons per man shift are reported from one of the thin seam longwalls. These results were attained by reliable high capacity equipment and roof support by shields that can be collapsed to as low as 22 inches. Maximum mining height for plow operated faces lies at 31.5 inches. Technology development for the future is discussed. DOE

**N82-14613#** California Univ., Livermore. Lawrence Livermore Lab.
**MATHEMATICAL MODELLING OF SOME CHEMICAL AND PHYSICAL PROCESSES IN UNDERGROUND COAL GASIFICATION**
John R. Creighton Aug. 1981 5 p Presented at the Eastern Section: The Combustion Inst. Conf., Pittsburgh, 27-29 Oct. 1981 Submitted for publication
(DE81-027941; UCRL-86518; CONF-811027-1) Avail: NTIS HC A02/MF A01

The chemical and physical processes governing underground coal gasification were conducted on laboratory scale experiments accompanied by mathematical modelling. Blocks of selected coal types are cut to fit 55 gallon oil drums and sealed in place with plaster. A 1 cm. diameter hole is drilled the length of the block and plumbing attached to provide a flow of air or oxygen/steam mixture. After an instrumented burn the block is sawed open to examine the cavity. Mathematical modelling is directed towards predicting the cavity shape. Sub models and their impact on predicted cavity shapes are examined. DOE

**N82-14614#** Sandia Labs., Albuquerque, N. Mex. Geothermal Technology Development Div.
**ACCESSING THE GEOTHERMAL RESOURCES**
James R. Kelsey 1981 6 p refs Presented at the Showcase for Technol. Conf., Albuquerque, N. Mex., 28 Oct. 1981
(Contract DE-AC04-76DP-00789)
(DE81-025396; SAND-81-1384C; CONF-811018-1) Avail: NTIS HC A02/MF A01

The technology development efforts in the areas of drilling, completion, and logging instrumentation are described. These development efforts are aimed at solving the problems associated with the high temperatures, hard-fractured geological formations, and corrosive formation fluids. DOE

**N82-14615#** Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Abteilung Satelliten und Sonden PRV-1.
**STUDY OF A COMBINED SATELLITE SYSTEM FOR REMOTE SENSING AND EARTH-ORIENTED RESEARCH (LOCSS) Final Report, Jul. 1980**
HansJuergen Guenther, Wolfgang Gericke, Hansjoerg Klotz, Rainer Krieger, Birgit Metzgar, Joachim Nauck, Klaus Plate, Rudolf Rohr, Gernot Schmidt, and Gerhard Schneider Bonn Bundesministerium fuer Forschung und Technologie Jan. 1981 222 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-002; ISSN-0170-1339) Avail: NTIS HC A10/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 38.60

The suitability of three European satellite platforms (ERD-SAT, SPAS, SPOT) for a combined satellite system (remote sensing and Earth-oriented research) is discussed. The system consists of two Sun-synchronous orbiting satellites with a combined remote sensing and Earth-oriented research payload and of a pure climatography satellite on a drift orbit. All platforms can accommodate the basic payload, but SPAS offers some advantages and is the only platform able to accommodate the extended payload. The combined three-satellite system offers cost advantages over the four-satellite system only if the space shuttle is used as launcher. Hence, SPAS should be given preference over the other platforms for such a system. The subsystem design is presented and problem areas are discussed. Data acquisition and data processing of image and climatic data are the bottlenecks in existing systems. Author (ESA)

**N82-14616#** Royal Aircraft Establishment, Farnborough (England). Remote Sensing Unit
**REMOTE SENSING INFORMATION BULLETIN; ISSUE NUMBER 6**
Jul. 1981 33 p
Avail: NTIS HC A03/MF A01

The activities of the Center up to July 1981 are reported. Topics include: the United Kingdom report to the seventh Earthnet meeting, in June 1981; satellite status reports for LANDSAT 1, 2, 3, and D; microwave remote sensing, including Seasat synthetic aperture radar; Mapsat feasibility study; Eros field office; and symposia and conferences organized by the Center, including a summer school on remote sensing applications in marine science and technology. Author (ESA)

**N82-14617#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group: Physics.

**PROJECT NOORDWIJK. PART 1: MEASUREMENTS OF THE RADAR BACKSCATTER COEFFICIENT GAMMA (SIGMA DEG) IN 1977 AND 1978**

G. P. deLoor Nov. 1979 42 p refs 2 Vol.
(PHL-1979-49-Pt-1; TDCK-73426) Avail: NTIS HC A03/MF A01

Radar backscatter measurements obtained from a sea platform are compared with airborne and spaceborne observations. A short range FM radar was mounted beside a television camera and directed into the prevailing winds. Upwind and crosswind data were collected, but downwind data are scarce, and more windspeed data are required. A systematic difference is observed between airborne and ground based data. The value of gamma is dependent on windspeed; dependency differs for the specular region (low incidence angles) and the diffuse (incidence angles > 45 deg). Author (ESA)

**N82-14618#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 4: Microwaves.

**PROJECT NOORDWIJK. PART 2: RESULTS OF NORTH SEA CLUTTER MEASUREMENTS IN THE I-BAND PERFORMED FROM THE PLATFORM NOORDWIJK IN SEPTEMBER/OCTOBER 1977**

H. Sittrop and H. Gravesteijn Aug. 1980 79 p refs 2 Vol.
(PHL-1980-28-Pt-2; TDCK-74302) Avail: NTIS HC A05/MF A01

Radar backscatter off the sea at low incidence angles was measured. A low frequency spectral analysis method is used to show that an appreciable periodic content exists in the sea return. This component in the scintillation spectra is 0.14 Hz and is related to the sea wave period. Wind-wave interaction effects are observed for up, down and crosswind directions. The clutter patch size and the incidence angle are used as a parameter. An optimum spectral response exists for upwind observations at an incidence angle of 1 deg and pulselength 0.08 microsec. The radar cross section per unit area measured is compared with an experimental sea clutter model. For wind directions resulting in an adequate fetch over open sea, reasonable agreement is found. No significant conclusions can be drawn with respect to megaripple observations. Author (ESA)

**N82-14619#** New Mexico State Univ., Las Cruces.

**WATER PROBLEMS AND RESEARCH NEEDS FOR NEW MEXICO**

Sep. 1980 60 p refs Sponsored by Office of Water Research and Technology
(PB81-231979; W81-04319) Avail: NTIS HC A04/MF A01 CSCL 13B

New Mexico faces serious water problems in the years ahead. Surface water supplies are scarce and virtually fully appropriated, so that no further appropriations can be made unless some existing water rights are retired. Fresh groundwater seriously depleted in some parts of the State from heavy drawdown. Existing fresh water supplies will not be adequate to meet all projected demands over the next 40 years. Significant aquifer recharge occurs only in the Rio Grande Basin, where unconsolidated sand and gravel reaches a charge thickness of up to 10,000 feet. Agricultural use annually depletes about 90% of fresh water withdrawals. It is unlikely that New Mexico will discover new water resources over the next few decades, so that water conservation in agriculture is critically important. GRA

**N82-14620#** Illinois State Geological Survey, Champaign.

**HYDROGEOLOGY OF SPOIL AT THREE ABANDONED SURFACE MINES IN ILLINOIS: PRELIMINARY RESULTS**

**Environmental Geology Notes, May 1981**

David E. Lindorff, Keros Cartwright, and Beverly L. Herzog Apr. 1981 24 p refs
(PB81-231664; IL/SGS/EGN-98) Avail: NTIS HC A02/MF A01 CSCL 08H

The impact of surface coal mining on the geologic materials and ground water in different geologic settings is under investigation at three abandoned surface mines in Illinois. At a site near Ottawa, the overburden prior to mining consisted largely of pyritic shale, sand was the major component of the overburden and spoil at a mine near Coal City. Clays, lacustrine silts, and some shale and limestone were the predominant premining overburden materials at a mine near Harrisburg. Ground water elevations at Coal City and Harrisburg are approximately at premining levels, where at Ottawa they are near the base of the spoil. Ground water quality has deteriorated at all three sites, especially at Ottawa and Harrisburg. GRA

**N82-14621#** North Carolina Water Resources Research Inst., Raleigh.

**ALGAL ASSAY STUDIES OF THE CHOWAN RIVER, NORTH CAROLINA**

Mary M. Sauer and Edward J. Kuenzler Apr. 1981 91 p refs (Contract DI-14-34-0001-0274)
(PB81-231821; W81-04303; OWRT-B-127-NC(2)) Avail: NTIS HC A05/MF A01 CSCL 08H

Assays were conducted on water collected from three stations to investigate the presence of limiting nutrients during the summer of 1980. Two types of algal inocula were used: the laboratory cultured green alga Selenastrum capricornutum and samples of the natural Chowan River phytoplankton. Phosphorus and nitrogen simultaneously limited total algal growth in most experiments; other nutrients did not significantly limit growth. Species-specific responses to nutrient enrichment occurred. Single additions of phosphorus increased numbers of nitrogen fixing blue-green algae. Therefore, phosphorus is the more critical limiting nutrient to growth of the bloomforming genera Anabaena and Aphanizomenon. GRA

**N82-14622#** Illinois State Geological Survey, Champaign.

**GEOCHEMISTRY OF RECENT LAKE MICHIGAN SEDIMENTS**

Richard A. Cahill 1981 102 p refs
(PB81-234429; IL/SGS/CIRC-517) Avail: NTIS HC A06/MF A01 CSCL 08H

A systematic sediment sampling of Lake Michigan was conducted. Distributions are reported for concentrations of 48 chemical elements for pH and Eh, and for grain size of 286 samples. Evaluating measurements of grain size and chemical composition led to classifying Lake Michigan surficial sediments by origin, as being from either depositional or nondepositional areas. The depositional areas include a number of sub-basins that have similar sediment properties and chemical composition. The distribution of trace elements, including heavy metals of anthropogeric origin, correlates positively with the abundance of fine-grained sediment. Clay minerals and organic materials are hosts for the relative enrichment of many of the trace elements in surficial sediments of the depositional basins. GRA

**N82-14623#** Utah Water Research Lab., Logan.

**CALCIUM CARBONATE PRECIPITATION AS INFLUENCED BY STREAM PRIMARY PRODUCTION**

Gretchen L. Rupp and V. Dean Adams Apr. 1981 62 p refs (Contract DI-14-34-0001-9047)
(PB81-231946; UWRL/Q-81/02; W81-04316; OWRT-A-044-UTAH(1)) Avail: NTIS HC A04/MF A01 CSCL 08H

The water chemistry, hydrology, and benthic primary production of the Logan River, in the Bear River Mountains in northern Utah, were monitored for one year to study the potential influence of periphyton photosynthesis and calcium carbonate precipitation in the river. Radioisotopic tracers were used to measure periphyton photosynthesis and calcium carbonate precipitation concurrently in laboratory experiments to investigate the effects of water temperature, velocity and macronutrient concentration on calcium carbonate precipitation induced by photosynthesis. GRA

**N82-14624#** Utah Agricultural Experiment Station, Logan.

**SALT RELEASE FROM SUSPENDED SEDIMENTS: A**

**SIMULATED MODEL**
Stanley R. Peterson, J. J. Jurinak, and R. J. Wagenet Dec. 1980 184 p refs
(Contract DI-14-34-0001-9047)
(PB81-231839; RR-62; W81-04304; OWRT-A-045-UTAH(1))
Avail: NTIS CSCL 08H

The effects of particle size, soil to water ratio and time on the rate of release of salts from Mancos Shale derived soils were studied by taking four different size fractions at three different dilutions of soil to water. The kinetic model was formulated using data obtained from a soil dominated by highly soluble salts (evaporites) and using dimensional analysis. The chemical equilibrium model was based on ion association theory. The requisite chemical equations programmed were solved by iterative techniques (successive approximations). The chemical model was interfaced with the kinetic model. The equilibrium model calculated the concentrations, activities, and activity coefficients for all ions and their soluble complexes. The model also predicted which salts were dissolving and by determining the saturation indices how quickly individual mineral salts approached equilibrium.GRA

**N82-14625#** GKY and Associates, Inc., Springfield, Va.
**FLOOD PLAIN MAPPING USING COMPUTER GRAPHICS Final Draft Report**
28 May 1981 81 p refs Prepared jointly with Ideamatics, Inc., Washington, D.C.
(Contract DI-14-34-0001-9630)
(PB81-231870; W81-04308; OWRT-C-90088-G(9630)(1))
Avail: NTIS HC A05/MF A01 CSCL 13B

The feasibility of using computer graphics to specify flood limits to Federal flood insurance and local flood easement delineation was investigated and demonstrated. Complex mathematical models were adapted to computer graphics output; HEC-2 water surface profiles, a state-of-the-art computer program developed by the Corps of Engineers, was adapted for use in this program. The computer configuration consisted of a PDP 11/45 mini-computer, a Sumagraphics digitizing tablet, and a Tektronix 4014-1 display terminal with a 4631 hard copier. Nine tasks were performed, including interfacing with the user community, adapting HEC-2 to an interactive/graphical output environment, selecting the hardware system most responsive to user capabilities; coding; debugging; testing the software; writing user manuals, and conducting demonstrations. GRA

**N82-14171#** Officine Galileo S.p.A., Florence (Italy).
**INFRARED RADIANCE MODEL VARIATION BY SENSOR FLIGHT MEASUREMENTS**
R. BaldassiniFontana, D. Sciacovelli (ESTEC, Noordwijk, Netherlands), and L. Fraiture (ESOC, Darmstadt, West Germany) *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 461-478 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

**N82-14626#** Open Univ., Milton (England). Energy Research Group.
**THE NUCLEAR CONTROVERSY: UNEQUAL COMPETITION IN PUBLIC POLICY-MAKING**
Ian Sanderson May 1980 76 p refs
(ERG-035) Avail: NTIS HC A05/MF A01

The public policy making process as regards nuclear power is analized and the epistemological basis for such an analysis is examined. It is asserted that disputes over the development of nuclear power are not primarily about the objective facts of the matter but rather derive from differences in basic assumptions about, and evaluatory perceptions of, society, technology and the nature of progress. The balance of power in such disputes is therefore not mainly determined by the 'correctness' of the facts upon which a position rests but rather by the extent to which underlying assumptions and values accord with prevailing ideological themes. A meaningful debate can be guaranteed only through the establishment of institutional structures which provide a framework of truely democratic participation and equality of power and influence. M.G.

**N82-14627*#** DHR, Inc., Washington, D.C.
**MARKET ASSESSMENT OF PHOTOVOLTAIC POWER SYSTEMS FOR AGRICULTURAL APPLICATIONS IN MOROCCO Final Report**
Henry Steingass and Itil Asmon (ARD, Inc.) Sep. 1981 157 p refs
(Contract DEN3-180; DE-AI01-79ET-20485)
(NASA-CR-165477; DOE/NASA/0180-2; C4100-50) Avail: NTIS HC A08/MF A01 CSCL 10A

Results of a month-long study in Morocco aimed at assessing the market potential for stand-alone photovoltaic systems in agriculture and rural service applications are presented. The following applications, requiring less than 15 kW of power, are described: irrigation, cattle watering, refrigeration, crop processing, potable water and educational TV. Telecommunications and transportation signalling applications, descriptions of power and energy use profiles, assessments of business environment, government and private sector attitudes towards photovoltaics, and financing were also considered. The Moroccan market presents both advantages and disadvantages for American PV manufacturers. The principle advantages of the Moroccan market are: a limited grid, interest in and present use of PV in communications applications, attractive investment incentives, and a stated policy favoring American investment. Disadvantages include: lack of government incentives for PV use, general unfamiliarity with PV technology, high first cost of PV, a well-established market network for diesel generators, and difficulty with financing. The market for PV in Morocco (1981-1986), will be relatively small, about 340 kwp. The market for PV is likely to be more favorable in telecommunications, transport signalling and some rural services. The primary market appears to be in the public (i.e., government) rather than private sector, due to financial constraints and the high price of PV relative to conventional power sector. M.D.K.

**N82-14628*#** Institute of Gas Technology, Chicago, Ill.
**STABILIZING PLATINUM IN PHOSPHORIC ACID FUEL CELLS Quarterly Report**
Robert J. Remick Oct. 1981 19 p refs
(Contracts DEN3-208; DE-1101-80ET-17088)
(NASA-CR-165483; DOE/NASA-0208/3; IGT-61051; QR-3) CSCL 10A

A carbon substrate for use in fabricating phosphoric acid fuel cell cathodes was modified by catalytic oxidation to stabilize the platinum catalyst by retarding the sintering of small platinum crystallites. Results of 100-hour operational tests confirmed that the rate of platinum surface area loss observed on catalytically oxidized supports was less than that observed with unmodified supports of the same starting material. Fuel cell electrodes fabricated from Vulcan XC-72R, which was modified by catalytic in a nitric oxide atmosphere, produced low platium sintering rates and high activity for the reduction of oxygen in the phosphoric acid environment. N.W.

**N82-14629*#** Ross (Bernd) Associates, San Diego, Calif.
**DEVELOPMENT OF AN ALL-METAL THICK FILM COST AFFECTIVE METALLIZATION SYSTEM FOR SOLAR CELLS Quarterly Report, Aug. - Oct. 1980**
Bernd Ross Sep. 1981 32 p refs
(Contract JPL-955688)
(NASA-CR-165044; QR-2; DOE/JPL-955688-80/2; JPL-9950-599) Avail: NTIS HC A03/MF A01 CSCL 10A

An economical thick film solar cell contact for high volume production of low cost silicon solar array modules was investigated. All metal screenable pastes using base metals were studied. Solar cells with junction depths varying by a factor of 3.3, with and without a deposited oxide coating were used. Cells were

screened and fired by a two step firing process. Adhesion and metallurgical results are unsatisfactory. No electrical information is obtained due to inadequate contact adhesion. S.L.

**N82-14630*#** Ross (Bernd) Associates, San Diego, Calif.
**DEVELOPMENT OF AN ALL-METAL THICK FILM COST EFFECTIVE METALLIZATION SYSTEM FOR SOLAR CELLS Quarterly Report, Nov. 1980 - Apr. 1981**
Bernd Ross Sep. 1981 40 p refs
(Contract JPL-955688)
(NASA-CR-165043; DOE/JPL-955688-80/3; JPL-9950-604; QR-3) Avail: NTIS HC A03/MF A01 CSCL 10A

The objectives of the investigation were to provide all-metal screenable pastes using economical base metals, suitable for application to low-to-high conductivity silicon of either conductivity type and possibly to aluminum surfaces. Experiments were conducted with variations in paste parameters, firing conditions, including gas ambients, furnace furniture, silicon surface and others. A liquid medium, intended to provide transport during the carbon fluoride decomposition was incorporated in the paste with promising results. T.M.

**N82-14631*#** Solarelectronics, Inc., Bellingham, Mass.
**FLAT-PLATE SOLAR ARRAY PROJECT. TASK 1: SILICON MATERIAL: INVESTIGATION OF THE HYDROCHLORINATION OF SiC1SUB4 Quarterly Report, 9 Jul. - 30 Sep. 1981**
Jeffrey Y. P. Mui 1 Oct. 1981 17 p refs
(Contract JPL-956061)
(NASA-CR-165042; DOE/JPL-956061/1; JPL-9950-607) Avail: NTIS HC A02/MF A01 CSCL 10A

A two inch-diameter stainless steel reactor was designed to operate at pressure up to 500 psig and at temperature up to 600 C in order to study the hydrochlorination of silicon tetrachloride and metallurgical grade (m.g.) silicon metal to trichlorosilane. The hydrochlorination apparatus is described and operation safety and pollution control are discussed. A.R.H.

**N82-14632*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**DESIGN OF AN ENERGY CONSERVATION BUILDING**
Ronald N. Jensen Nov. 1981 32 p refs
(NASA-TM-83175) Avail: NTIS HC A03/MF A01 CSCL 10A

The concepts in designing and predicting energy consumption in a low energy use building are summarized. The building will use less than 30,000 Btu/sq.ft./yr. of boarder energy. The building's primary energy conservation features include heavy concrete walls with external insulation, a highly insulated ceiling, and large amounts of glass for natural lighting. A solar collector air system is integrated into the south wall. Calculations for energy conservation features were performed using NASA's NECAP Energy Program. T.M.

**N82-14633*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
**ALUMINUM BLADE DEVELOPMENT FOR THE MOD-0A 200-KILOWATT WIND TURBINE Final Report**
Bradford S. Linscott, Richard K. Shaltens, and A. G. Eggers (Westinghouse Electric Corp., Pittsburg) Dec. 1981 43 p refs
(Contract DE-AB29-76ET-20370)
(NASA-TM-82594; DOE/NASA-20370/20) Avail: NTIS HC A03/MF A01 CSCL 10A

The rotor blade configuration, fabrication methods, analyses, operating experience, design modifications, and cost are described. Each 60-ft.-(18.3-m-) long aluminum blade used current aircraft fixed wing and rotary wing design and fabrication technologies. Structural damage, repairs, and modifications that occurred during 6500 hours of operation are summarized. T.M.

**N82-14634*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATELLITE POWER SYSTEM: CONCEPT DEVELOPMENT AND EVALUATION PROGRAM. VOLUME 4: ENERGY CONVERSION AND POWER MANAGEMENT**
Nov. 1981 369 p refs
(NASA-TM-58237-Vol-4) Avail: NTIS HC A16/MF A01 CSCL 10A

Additional analyses that were performed to supplement the NASA/Department of Energy (DOE) Satellite Power System (SPS) reference system concept are presented in this volume. A brief review of the reference concept is provided together with detailed descriptions of energy conversion, power distribution, and power management for solar photovoltaics (silicon and gallium arsenide), solar thermal (Brayton and Rankine cycles), and concept comparisons (solar thermal and energy conversion). Results of other studies concerning energy conversion and power management (environmental impacts, annealing, nuclear SPS concept, and thermionic) are included. The data presented were taken from the SPS Concept Definition Studies performed under the direction of NASA by Rockwell International Corporation and Boeing Aerospace Company. Author

**N82-14635*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**SATELLITE POWER SYSTEM: CONCEPT DEVELOPMENT AND EVALUATION PROGRAM. VOLUME 7: SPACE TRANSPORTATION**
Nov. 1981 258 p refs
(NASA-TM-58238-Vol-7) Avail: NTIS HC A12/MF A01 CSCL 10A

During the several phases of the Satellite Power System (SPS) Concept Definition Study, various transportation system elements were synthesized and evaluated on the basis of their potential to satisfy overall SPS transportation requirements and their sensitivities, interfaces, and impact on the SPS. Additional analyses and investigations were conducted to further define transportation system concepts that will be needed for the developmental and operational phases of an SPS program. To accomplish these objectives, transportation systems such as the Shuttle and its derivatives have been identified; new heavy-lift launch vehicle (HLLV) concepts, cargo and personnel orbital transfer vehicles (COTV and POTV), and intra-orbit transfer vehicle (IOTV) concepts have been evaluated; and, to a limited degree, the program implications of their operations and costs were assessed. The results of these analyses have been integrated into other elements of the overall SPS concept definition studies. Author

**N82-14636*#** General Dynamics/Convair, San Diego, Calif.
**STUDY OF MULTI-MEGAWATT TECHNOLOGY NEEDS FOR PHOTOVOLTAIC SPACE POWER SYSTEMS. VOLUME 1: EXECUTIVE SUMMARY**
D. M. Peterson and R. L. Pleasant 1 Aug. 1981 28 p refs 2 Vol.
(Contract NAS3-21951)
(NASA-CR-165323-Vol-1; Rept-111-2401-204) Avail: NTIS HC A03/MF A01 CSCL 10A

Possible missions requiring multimegawatt photovoltaic space power systems in the 1990's time frame and associated power system technology needs are examined. The following concepts for photovoltaic power approaches are considered: planar arrays, concentrating arrays, hybrid systems using Rankine engines, thermophotovoltaic and AC/DC power management approaches, battery, fuel cell, flywheel energy storage, and interactions with the electrical ion engine injection and stationkeeping system. The levels of modularity for efficient, safe, constructable, serviceable, and cost effective system design are analyzed, and the benefits of alternate approaches developed. Both manned low Earth orbit and unmanned geosynchronous Earth orbit applications were examined for technological development. Technology developments applicable to power systems which appear to have benefits independent of the absolute power level are suggested. M.D.K.

**N82-14637*#** General Dynamics/Convair, San Diego, Calif.
**STUDY OF MULTI-MEGAWATT TECHNOLOGY NEEDS FOR PHOTOVOLTAIC SPACE POWER SYSTEMS, VOLUME 2 Final Report**
D. M. Peterson and R. L. Pleasant 19 Mar. 1981 285 p refs 2 Vol.
(Contract NAS3-21951)
(NASA-CR-165323-Vol-2; GDC-AST-81-019-Vol-2) Avail: NTIS HC A13/MF A01 CSCL 10A

Possible missions requiring multimegawatt photovoltaic space power systems in the 1990's time frame and power system

technology needs associated with these missions are examined. Four specific task areas were considered: (1) missions requiring power in the 1-10 megawatt average power region; (2) alternative power systems and component technologies; (3) technology goals and sensitivity trades and analyses; and (4) technology recommendations. Specific concepts for photovoltaic power approaches considered were: planar arrays, concentrating arrays, hybrid systems using Rankine engines, thermophotovoltaic approaches; all with various photovoltaic cell component technologies. Various AC/DC power management approaches, and battery, fuel cell, and flywheel energy storage concepts are evaluated. Interactions with the electrical ion engine injection and stationkeeping system are also considered. M.D.K.

**N82-14638#** Texas Technological Univ., Lubbock. Plasma and Switching Lab.

**PULSED POWER RESEARCH COLLOQUIUM Annual Report**

M. Kristiansen, A. H. Guenther (Kirtland AFB, Albuquerque, N.M.), John Ungvarsky (AFWL, Kirtland AFB, Albuquerque, N.M.), F. C. Brockhurst (Air Force Inst. of Technology, Wright-Patterson, AFB, Ohio), R. D. Franklin (AFWAL), A. K. Hyder (AFOSR), and R. L. Gullickson (Defense Nuclear Agency) 9 Jul. 1981 10 p refs

(Grant AF-AFOSR-3675-78; AF Proj. 2301)

(AD-A105770; AFOSR-81-0686TR) Avail: NTIS HC A02/MF A01 CSCL 10/2

A Pulsed Power Lecture Series is being conducted by Texas Tech University for the U.S. Air Force. Modular instructional material for use in this lecture series is being developed. Each module is a self consistent discussion of some aspect of pulsed power technology. The contents range from the very basic (e.g. basic EM field theory) to advanced, modern topics, such as magnetic switching. The lectures are delivered every two weeks at the Air Force Institute of Technology and the Air Force Weapons Laboratory. The speakers then provide a written text of their lecture, which is edited and published in modular form by Texas Tech University. It is planned to reissue these modules in report or book form at a later date. A total of about 50 modules are planned. Some 30 lecturers have been presented, to date, and about 12 modules have been issued. Author (GRA)

**N82-14639#** Pope, Evans, and Robbins, Inc., New York.

**EVALUATION OF COAL GASIFICATION/COMBINED CYCLE POWER PLANT FEASIBILITY AT THE SEWELLS POINT NAVAL COMPLEX, NORFOLK, VIRGINIA Final Report**

Jul. 1981 235 p refs

(Contract N62470-80-C-3736)

(AD-A103674) Avail: NTIS HC A11/MF A01 CSCL 10/2

The feasibility of installing a coal gasification/combined cycle cogeneration plant at Sewells Point Naval Complex, Norfolk, Virginia is evaluated. Current gasification technology, combined cycle thermodynamics, environmental control requirements, and conventional coal fired cogeneration cycles are addressed. The utility interface, site considerations, and economic analyses are also presented. It is concluded that a coal gasification/combined cycle cogeneration plant supplying 50 MW of electric power and 290,000 lb/hr of steam is technically feasible. M.D.K.

**N82-14640#** Imperial Coll. of Science and Technology, London (England). Unit for Solid State Ionics.

**LITHIUM BASED ANODES FOR SOLID STATE BATTERIES Final Scientific Report, 30 Sep. 1977 - 30 Sep. 1980**

R. A. H. Edwards, J. R. Owen, and B. C. H. Steele 30 Jun. 1981 39 p refs

(Grant AF-AFOSR-3460-77; AF Proj. 2303)

(AD-A105518; AFOSR-81-0652TR) Avail: NTIS HC A03/MF A01 CSCL 10/3

Two previous reports are reviewed and last year's work is detailed. The latter involved the use of 'staircase wave cyclic voltammetry,' a technique designed to characterize the transport properties of an electrode material over a wide composition range. This technique was applied to the compounds Fe, Si, a glassy metal of composition (FeSi)B, and a newly found prospective negative plate material HgxLi. An analysis of composite electrodes - those containing an additional ionic conductor, e.g. a solid electrolyte, as the grain boundary phase of the charge storage material shows that the criteria initially applied to the selection of an electrode may be significantly relaxed. Experiments with the composite of lithium-aluminum alloy with the solid electrolyte polyethylene oxide-lithium trifluoromethane sulphonate have verified the analysis which can be applied to many more systems. Author (GRA)

**N82-14641#** Boeing Aerospace Co., Seattle, Wash.

**HIGH VOLTAGE TESTING Interim Report, 24 Sep. 1979 - 20 Jan. 1981**

W. G. Dunbar Wright-Patterson AFB, Ohio AFWAL Aug. 1981 93 p refs

(Contract F33615-79-C-2067; AF Proj. 3145)

(AD-A106029; AFWAL-TR-81-2023) Avail: NTIS HC A05/MF A01 CSCL 10/2

The High Voltage Design Guide and High Voltage Specifications and Tests Documents referred to in this report pertain to high voltage/high power airborne equipment. A test plan was designed to evaluate and verify test parameters specified in these documents. This was done by writing detailed test procedures, obtaining representative test samples, and testing the specified parameters. In addition, a standard test fixture and corona-free 150 kV, 400 Hz power supply was specified, evaluated, and delivered for use with a partial discharge test set. Author (GRA)

**N82-14642#** United Technologies Corp., South Windsor, Conn. Power Systems Div.

**INVESTIGATION OF THE IN-SITU OXIDATION OF METHANOL IN FUEL CELLS Final Report, Jun. 1980 - May 1981**

D. A. Landsman and F. J. Luczak Sep. 1981 32 p refs

(Contract DAAK70-80-C-0049; DA Proj. 1L1-61102-AH-51)

(AD-A105947; FCR-3463) Avail: NTIS HC A03/MF A01 CSCL 10/2

Direct anodic oxidation and internal reforming were examined as ways of using methanol as fuel in a phosphoric acid fuel cell. The literature was reviewed to identify the most effective catalysts for the direct electrochemical oxidation of methanol. It is shown that, even with the best of these catalysts, anode polarization at practical current densities is 300 mV higher on methanol than on hydrogen. It was also found that unreacted methanol which diffuses across the cell can cause severe polarization of the cathode. Theoretical and experimental studies of internal reforming showed that a fuel cell will generate sufficient waste heat to sustain the methanol steam reforming reaction. Thus, thermally integrated, internal reforming is a feasible alternative to external reforming. The reforming catalyst is preferably located in separate chambers built into the stack, since this prevents phosphoric acid from attacking the reforming catalyst and methanol from migrating to the cathode. Author (GRA)

**N82-14643#** Arabian Exhibition Management Ltd., Manama (Bahrain).

**SOLTECH 80**

1980 174 p Conf. held at Bahrain, 10-11 Nov. 1980

(DE81-901931; CONF-801178) Avail: NTIS (US Sales Only) HC A08/MF A01; DOE Depository Libraries

Three solar related activities: solar radiation monitoring, effects of dust accumulation on collector performance, and salt gradient solar pond analytical and experimental studies are described. Measurements of total horizontal and direct radiation are made continuously, and the data are presented in a user oriented format on an hourly basis. Diffuse radiation and total radiation on a surface tilted to the local latitude angle are calculated. The system is presently being expanded to allow measurement of several additional radiation parameters of interest as well as six meteorological parameters. The effects of atmospheric dust on radiation attenuation, as well as the clearness index, anti K/sub T/ are shown. The impact of surface dust accumulation on the performance of photovoltaic and thermal collectors is also studied. DOE

**N82-14644#** American Bar Association, Washington, D.C. Special Committee on Energy Law.

**NEED FOR POWER AND THE CHOICE OF TECHNOLOGIES: STATE DECISIONS ON ELECTRIC POWER FACILITIES**

Jun. 1981 221 p refs

(Contract DE-AC01-79RG-10004)

(DE81-025960; DOE/EP-10004/1) Avail: NTIS HC A10/MF A01

The decision-making processes at the state level regarding

the licensing of electric generating facilities were assessed. The basic issues addressed are the need for power and choice of technology: state decisions which directly influence and affect the nation's energy supply, and the tradeoffs involved in meeting energy demand. The areas of special emphasis included the legal mechanisms and regulatory procedures used to determine and resolve these issues. The effectiveness of state decision-making was assessed, focusing on legal and administrative histories and accommodation of interests of concerned parties. Recent innovations to enhance the decision-making process were also assessed where applicable. No particular substantive results are advocated in the findings. The recommendations presented are broad in scope. DOE

**N82-14645#** Natural Resources Defense Council, Inc., San Francisco, Calif.

**PROJECTING REGIONAL POTENTIALS FOR COST-EFFECTIVE ENERGY CONSERVATION AND RENEWABLE RESOURCE APPLICATIONS: A FEASIBILITY STUDY**

1980 52 p refs

(Contract DE-FG03-79CS-10045)

(DOE/CS-10045/T3) Avail: NTIS HC A04/MF A01

The feasibility is discussed of preparing an instruction manual that would enable a modeler in a particular region to set up a calculation method or predicting energy use. Such a manual would concern itself primarily with the three energy-consuming sectors most relevant to utilities' demand projections. Data requirements for each of the three sectors (residential, commercial, and industrial) are described and some initial guidance is provided as to how these needs can be filled. The methods for separate calculations of energy consumed by each end use in each sector are described. Each end use is discussed separately for the residential sector, but only in aggregate for the commercial and industrial sectors. DOE

**N82-14646#** Westinghouse Electric Corp., Concordville, Pa. Combustion Turbine Systems Div.

**COMPRESSED AIR ENERGY STORAGE PRELIMINARY DESIGN AND SITE DEVELOPMENT PROGRAM IN AN AQUIFER. VOLUME 5, PART 2, APPENDIX F, DYNAMIC SYSTEM COMPUTER MODEL Final Report**

P. A. Berman, J. S. Bonk, W. F. Kobett, N. S. Kosanovich, L. J. Long, and D. J. Marinacci 31 Jul. 1981 489 p refs Sponsored in part by Electric Power Research Inst., Palo Alto, Calif. Prepared for Public Service Company of Indiana, Inc.

(Contracts DE-AC02-78ET-29232; ET-78-C-01-2159; EPRI Proj. 1081-3)

(DE82-000671; DOE/ET-29232/T4-Vol-5-Pt-2) Avail: NTIS HC A21/MF A01

The computer program and subroutines written to provide a general purpose modeling tool for a compressed air energy storage (CAES) power plant system are documented. The CAES plant was modeled using FORTRAN and a Control Data Corporation 7600 digital computer. The system model was developed to learn the transient response characteristics of the complete CAES plant; provide a tool for evaluating the requirements and performance of control systems proposed for the CAES plant; provide a general purpose digital-computer-based dynamic modeling tool; and provide power plant component models as FORTRAN subroutines which can be used, with appropriate parameter data, as modules in complete CAES power plant models. DOE

**N82-14647#** California Univ., Livermore. Lawrence Livermore Lab.

**ENERGY AND TECHNOLOGY REVIEW**

Sep. 1981 40 p refs

(Contract W-7405-eng-48)

(DE82-000304; UCRL-5200-81-9) Avail: NTIS HC A03/MF A01

Three articles on optical fibers used in nuclear test diagnostics, understanding the physics of explosion products, and arms control in the eighties are presented. Advantages of optical fiber systems incorporating wavelength multiplexers and efficient scintillators compared with the coaxial cables used in nuclear detonation diagnosis are discussed. Thermodynamic data on detonation properties of various high explosives are evaluated. Arms control policies and negotiating goals discussed by representatives from government and academia are reported. DOE

**N82-14648#** Purdue Univ., Lafayette, Ind. Energy Policy Research and Information Program.

**PROGRESS REPORT TO THE DEPARTMENT OF ENERGY IN SUPPORT OF BASIC ENERGY AND POLICY RESEARCH**

15 Jul. 1981 326 p refs

(Contract DE-AS02-79ER-10044)

(DE81-025882; DOE/ER-10044/T1) Avail: NTIS HC A15/MF A01

Research areas include: light path of carbon reduction in photosynthesis: heat transfer in coal-ash slags; mechanism of plant cell enlargement in Gymnosperms; emulsion stability in enhanced oil recovery; selective transfer phenomenon in friction and wear; conceptual design of the Purdue Compact Torus/Passive Liner Fusion Reactor; integration of farm level alcohol production consistent with the economic and labor constraints of a farming operation, and newsmedia coverage of selected energy policy proposals. DOE

**N82-14649#** California Univ., Livermore. Lawrence Livermore Lab.

**FIRE-PROTECTION RESEARCH FOR ENERGY TECHNOLOGY: FY 80 YEAR END REPORT**

H. K. Hasegawa, N. J. Alvares, A. E. Lipska, H. Ford, S. Priante, and D. G. Beason 26 May 1981 118 p refs

(Contract W-7405-eng-48)

(DE82-000970; UCRL-53179) Avail: NTIS HC A06/MF A01

This continuing research program was initiated in order to advance fire protection strategies for Fusion Energy Experiments (FEE). The program expanded to encompass other forms of energy research. Accomplishments for fiscal year 1980 were: finalization of the fault-free analysis of the Shiva fire management system; development of a second-generation, fire-growth analysis using an alternate model and new LLNL combustion dynamics data; improvements of techniques for chemical smoke aerosol analysis; development and test of a simple method to assess the corrosive potential of smoke aerosols; development of an initial aerosol dilution system; completion of primary small-scale tests for measurements of the dynamics of cable fires; finalization of primary survey format for non-LLNL energy technology facilities; and studies of fire dynamics and aerosol production from electrical insulation and computer tape cassettes. DOE

**N82-14650#** Argonne National Lab., Ill. Integrated Assessments and Policy Evaluation Group.

**ANALYSIS OF POTENTIAL COGENERATION IMPACTS ON ELECTRICITY GENERATION BY THE CENTRAL MAINE POWER COMPANY**

Jerry L. Gillette and Kenneth A. Hub Apr. 1981 36 p refs

(Contract W-31-109-eng-38)

(DE81-029991; ANL/CNSV-TM-76) Avail: NTIS HC A03/MF A01

Two types of cogeneration design - one utilizing a backpressure turbine, the other an extraction turbine - were studied. It was assumed that these facilities were constructed to produce electricity that could be sold to the electric utility. The analysis included a single-year study of two different capacity-purchase options under consideration by the electric utility. An extended period was also analyzed so that the effects of demand growth and additions and subtractions of capacity on the cogeneration potential could be examined. It is found that some savings of oil could be realized with coal-based cogeneration, and that the quantity of such savings are somewhat dependent on the purchase option, the demand growth rate, and the cogenerator design. It is concluded that both cogenerator designs have some economic viability, but that the backpressure turbine type has a decided advantage due to its significantly lower heat rate. T.M.

**N82-14651#** California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

**ANALYSIS OF THE ENERGY IMPACTS OF THE DOE APPROPRIATE ENERGY TECHNOLOGY SMALL GRANTS PROGRAM: METHOD AND RESULTS**

Bart Lucarelli, Jeff Kessel, Josh Kay, Janet Linse, Susan Tompson, and Mark Horner Aug. 1981 43 p refs

(Contract W-7405-eng-48)
(DE81-029844; LBL-12253-Rev) Avail: NTIS HC A03/MF A01

Methods for assessing the energy savings of projects in the appropriate technology program (AT) and how to apply these methods to obtain estimates of energy impacts was studied. Program energy savings were estimated from project savings by statistical inference. Direct energy savings and methods and results of the economic analysis are discussed. Indirect energy savings and program energy savings and the methods used to obtain them are estimated. Improvement of project selection which increase program energy savings and two approaches for conducting future energy impact studies are presented. DOE

**N82-14652#** Battelle Pacific Northwest Labs., Richland, Wash. Office of Seasonal Thermal Energy Storage Program.

**WASTE HEAT AND CHILL STORAGE IN AQUIFER SYSTEMS**

Jay R. Eliason 1981 10 p refs Presented at the 3rd Conf. on Waste Heat Management and Utilization, Miami, Fla., 12 May 1981
(Contract DE-AC06-76RL-01830)
(DE81-028016; PNL-SA-9164; CONF-810545-6) Avail: NTIS HC A02/MF A01

Seasonal storage of thermal energy in aquifers is discussed. Winter chill, summer heat, and various forms of industrial waste heat and chill can be stored for future demand, reducing the need for generating primary energy. This seasonal storage of heat and chill in aquifer systems is assessed. DOE

**N82-14653#** Department of Energy, Washington, D. C. Office of Market Analysis.

**INTERNATIONAL ENERGY INDICATORS**

R. M. Weiss, ed. Jul. 1981 30 p
(DE81-028117; DOE/IA-0010/13) Avail: NTIS HC A03/MF A01

Data are presented in graphs and tables on the following: world crude oil production by area, annually, 1974 through 1980, and monthly, October 1980 through April 1981; OPEC crude oil productive capacity, installed, maximum sustainable, and available, by country; world crude oil and refined product inventory levels, 1975 through 1981; oil consumption in OCED countries, 1975 through 1981; USSR crude oil production and exports, 1975 through April 1981; free world (by country) and US nuclear electricity generation, 1973 through 1980 and January to May 1981 and current capacity by country; US domestic oil supply (monthly) 1977 through 1980; US gross imports of crude oil and products, 1973 and 1974 annually, and 1975 through 1980 and monthly from January to June 1981; cost of Saudi crude oil in current and 1974 dollars from December 1974 through March 1981; US coal trade from January 1975 to March 1981; US natural gas trade from January 1975 through April 1981; summary of US merchandise trade, quarterly, from Quarter I, 1977 through Quarter I, 1981; and US energy/GNP ratio, annually, 1974 through 1980, and quarterly from 1974 through March 1981. DOE

**N82-14654#** Gould, Inc., Rolling Meadows, Ill.

**THERMAL BEHAVIOR OF AN EXPERIMENTAL 2.5-KWH LITHIUM/IRON SULFIDE BATTERY**

C. C. Chen, T. W. Olszanski, and H. F. Gibbard Oct. 1981 5 p refs Presented at the Electrochem. Soc. Conf., Denver, 11 Oct. 1981 Prepared for California Univ., Berkeley. Lawrence Berkeley Lab.
(Contracts W-7405-eng-48; W-31-109-eng-38)
(DE81-029861; LBL-13076; CONF-811013-3) Avail: NTIS HC A02/MF A01

The thermal energy generation and the gross thermal energy balance in the battery systems was studied. High temperature lithium/iron sulfide batteries for electric vehicle applications were developed. The preferred battery temperature range during operation and idle periods is 400 to 500 C. Thermal management is an essential part of battery design, the battery requires a thermal insulation vessel to minimize heat loss and heating and cooling systems to control temperature. Results of temperature measurements performed on a 2.5-kWh battery module, which was built to gain information for the design of larger systems are reported. DOE

**N82-14655#** California Univ., Livermore. Lawrence Livermore Lab.

**FLYWHEEL ROTOR AND CONTAINMENT TECHNOLOGY DEVELOPMENT**

S. V. Kulkarni 11 Aug. 1981 14 p refs Presented at the Mech., Magnetic, and Underground Energy Storage 1981 Ann. Contractors' Rev. Meeting, Washington, D.C., 24-27 Aug. 1981
(Contract W-7405-eng-48)
(DE81-028047; UCRL-86557; CONF-810833-7) Avail: NTIS HC A02/MF A01

An economical and practical composite flywheel with an energy density of 88 Wh/kg at failure, an operational energy density of 44 to 55 Wh/kg, and an energy storage capacity of approximately 1 kWh was developed. The suitability of various manufacturing processes for low cost rotor fabrication is determined, flywheel and flywheel systems dynamics are investigated. Prototype rotors for use in transportation and stationary applications and a fail safe, lightweight, and low cost flywheel containment are evaluated. DOE

**N82-14656#** Lincoln Lab., Mass. Inst. of Tech., Lexington.

**PHOTOVOLTAIC SYSTEMS PERFORMANCE EXPERIENCE**

F. J. Solman 1981 8 p refs Presented at IEEE Photovoltaic Specialists Conf., Orlando, Fla., 11-15 May 1981
(Contract DE-AC02-76ET-20279)
(DE81-025725; DOE/ET-20279/147; CONF-810526-39) Avail: NTIS HC A02/MF A01

The photovoltaic power systems at Natural Bridges National Monument in southeastern Utah and at radio station WBNO in Bryan, Ohio, provided reliability experience and case histories on failures and repairs of large photovoltaic systems. The PV systems are used for illustration of potential sources of system outages and measures that can be taken to improve the reliability and repair economy of present and future PV systems. Both systems have experienced lighting strikes, and the results are reported. E.A.K.

**N82-14657#** Lincoln Lab., Mass. Inst. of Tech., Lexington.

**SOLAR PHOTOVOLTAIC RESIDENTIAL PROJECT. PROJECT INTEGRATION MEETING, AGENDA AND ABSTRACTS**

1981 63 p refs Presented at Solar Photovoltaic Residential Project Integration Meeting, Cambridge, Mass., 24-25 Jun. 1981
(Contract DE-AC02-76ET-20279)
(DE81-028433; DOE/ET-20279/150; CONF-8106143) Avail: NTIS

Thirty three abstracts are presented covering: residential photovoltaic design, economics and requirements, balance of system components, PV/thermal collectors, PV interfaced with passive solar design, and utilities related aspects. DOE

**N82-14658#** Midwest Research Inst., Golden, Colo.

**SYSTEMS ANALYSIS OF THERMAL STORAGE**

R. J. Copeland Aug. 1981 8 p refs Presented at the Ann. Meeting on Thermal and Chem. Storage, Tysons Corner, Va., 14-16 Sep. 1981
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE81-030288; SERI/TP-253-1369; CONF-81940-2) Avail: NTIS HC A02/MF A01

Analyses were conducted on thermal storage concepts for solar thermal applications. These studies include estimates of both the obtainable costs of thermal storage concepts and their worth to a user (i.e., value). Based on obtainable costs and performance, an in-depth study evaluated thermal storage concepts for water/steam, organic fluid, and gas/Brayton solar thermal receivers. Promising and nonpromising concepts were identified. Thermal storage concepts were evaluated for a liquid metal receiver. The value of thermal storage in a solar thermal industrial process heat application was analyzed. Several advanced concepts studied, include ground-mounted thermal storage for parabolic dishes with Stirling engines. DOE

**N82-14659#** Energy, Inc., Idaho Falls, Idaho.

**ENERGY RECOVERY FROM MUNICIPAL WASTE DEVELOPMENT PROGRAM FOR IDAHO FALLS, IDAHO Final Report**

Jul. 1981 155 p refs

(Contract DE-AC01-79CS-20240)
(DE81-029999; DOE/CS-20240/1) Avail: NTIS HC A08/MF A01

The development of a demonstration facility to show that fluidized-bed technology is a viable means to recover resources from municipal wastes in Idaho Falls is described. The tasks described include: (1) evaluation of the energy market of Idaho Falls to identify potential customers for recovered energy and to determine what form of energy would be economically viable; (2) evaluation of the municipal solid waste of Idaho Falls, determining its approximate composition, heating value, production rates, and seasonal variations; (3) development of a resource recovery facility concept that will be economically attractive to the city and technically feasible; and (4) evaluation of such topics as zoning, legal limitations, and environmental aspects of the facility to determine its compatibility with the city of Idaho Falls. DOE

**N82-14660#** Iowa State Univ. of Science and Technology, Ames. Dept. of Agricultural Engineering.
**DEVELOPMENT OF A BIOMASS ENERGY SYSTEM FOR DRYING CORN Final Report, 1 Jul. 1979 - 30 Jun. 1981**
W. F. Buchele, P. W. Claar, II, and S. J. Marley 1981 109 p refs
(Contracts DE-AS02-78CS-40059; EM-78-S-02-4916)
(DE81-029027; DOE/CS-40059/T1; COO-4916) Avail: NTIS HC A06/MF A01

A direct-combustion furnace for burning agricultural crop residue was developed. The design and operating parameters of an incinerator-type furnace were evaluated along with existing furnace types for application to burning agricultural crop residue. The design, fabrication, and evaluation of three direct-combustion, biomass-fueled furnaces were accomplished. Economic and energy analysis for the utilization of agricultural crop residue on a cornbelt farm were performed and the quantities of corn residue produced on a cornbelt farm and the effect of residue removal harvest rates on the amount of cover remaining and the resulting impact on soil erosion hazard were determined. DOE

**N82-14661#** Mid-American Solar Energy Complex, Minneapolis, Minn.
**SEMINARS FOR PRIVATE COLLEGE ADMINISTRATORS ON SOLAR APPLICATIONS FOR COLLEGE BUILDINGS**
Jun. 1981 8 p
(Contract DE-AC02-79CS-30150)
(DE81-027981; MASEC-CF-81-038) Avail: NTIS HC A02/MF A01

The objective of this project was to increase the working knowledge of key private college decision makers on passive and active solar fundamentals, proven passive and active technology, and conservation means integral to these technologies in the renovation of college buildings or their energy systems, to be achieved by conducting a series of three seminars. A summary of the project activities and a brief summary of workshop evaluations are given. DOE

**N82-14662#** California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
**POTENTIAL ENERGY SAVINGS IN THE RESIDENTIAL SECTOR OF THE UNITED STATES**
John Ingersoll Jun. 1981 11 p refs Presented at the Intern. Conf. on Energy Use Management, West Berlin, 26-30 Oct. 1981
(Contract W-7405-eng-48)
(DE81-028873; LBL-12862; CONF-811006-3) Avail: NTIS HC A02/MF A01

The state-of-the-art computer program, DOE 2.1, was used to simulate the hour-by-hour thermal performance of residential buildings in the four major climate zones of the United States, and a life-cycle cost analysis was applied to determine the optimal energy requirement of a typical house demonstrate that present levels of energy consumption can be reduced by a factor of two without compromising health and comfort standards. Within present technology, additional energy savings can be achieved but not yet in a cost-effective way. DOE

**N82-14663#** Battelle Pacific Northwest Labs., Richland, Wash.
**PROGRESS ON CATALYZED STEAM GASIFICATION OF BIOMASS**
L. K. Mudge, D. H. Mitchell, S. L. Weber, L. J. Sealock, Jr., and R. J. Robertus Mar. 1981 54 p refs Presented at the 12th Biomass Thermochem. Conversion Contractors Meeting, Washington, D.C., 18-19 Mar. 1981
(Contract DE-AC06-76RL-01830)
(DE81-028198; PNL-SA-9350; CONF-810360-4) Avail: NTIS HC A04/MF A01

Operations in the process development unit (PDU) on evaluation of yields with a wood feedstock were completed at atmospheric pressure, after which modifications for operations at 10 psig were initiated. The economics of two plants for generation of methane from wood and methanol from wood were determined; evaluations were based on data from the PDU. The ASPEN computer code developed for updating process economics and for evaluating alternative processing schemes is described. Catalyst life, regeneration, and characterization for systems that generate a synthesis gas and a methane rich gas from wood are addressed. Development of a durable catalyst for the PDU and a catalyst resistant to carbon deposition was also studied. The thermal behavior of wood with and without impregnated potassium carbonate was determined from pyrolysis conditions. Wood was gasified with steam with and without a secondary nickel catalyst. Plant capacities of 2000 and 200 dry tons/day were considered. Changes in process yields and requirements resulted from contained studies in the laboratory and PDU. DOE

**N82-14664#** Oak Ridge Associated Universities, Tenn.
**EDUCATION AND TRAINING IMPLICATIONS OF BIOMASS ENERGY SYSTEM USE**
S. E. Bell, R. M. Gove, and J. R. Little Aug. 1981 44 p refs
(Contract DE-AC05-76OR-00033)
(DE81-029956; ORAU-182) Avail: NTIS HC A03/MF A01

Direct observations of 189 biomass-related operations combined with existing reports, feasibility studies, and expert opinion are used to assess the education and training implications of biomass energy system use. The number of permanent jobs in activities related to biomass energy production could easily reach the hundreds of thousands by the end of the century. However, national employment related to biomass energy will represent only a very small portion of the employment in any major occupational category. In addition, an analysis of occupational skill requirements suggests that the impacts on education and training institutions are likely to be minimal. Regional shortages could develop for foresters, forestry technicians, chemists, laboratory technicians, process operators, and certain engineers; but these are likely to be in response to economy-wide growth rather than biomass energy-related activity alone. DOE

**N82-14665#** Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
**REPEAT FACILITY. REPORT FOR MAY, JUNE, JULY Progress Report, May - Jul. 1981**
C. Byron Winn Aug. 1981 79 p refs
(Contract DE-AS02-80CS-30259)
(DE81-028156; DOE/CS-30259/6) Avail: NTIS HC A05/MF A01

The construction of the REPEAT facility, a test facility for passive and hybrid solar heating systems is reported. The development of a simulation program for envelope type passive solar systems, constructing an envelope test cell, collecting data to validate the program, and application of the program to determine the best envelope type design are discussed. A low cost monitoring system using a dedicated microprocessor system, an inexpensive, high accuracy A/D converter, and minimum system hardware is developed. A method to determine the average temperature and the average daily temperature variation inside a passively heated solar building is presented. DOE

**N82-14666#** Bonn Univ. (West Germany). Inst. fuer Physikalische Chemie.
**ELECTRODES AND DIAPHRAGMS FOR FUEL CELLS Final Report, Dec. 1979**
Wolf Vielstich and Ernst Knauf Bundesministerium fuer Forschung und Technologie Feb. 1981 45 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-81-047; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9.50

Nickel whisker electrodes with variations in network structure, pore size, and metal coatings were produced for use in water electrolytic cells and fuel cells. The resistance due to gas bubbles was decreased considerably by slits milled into the electrode. Platinization was optimized for use in glycol/air cells and glycol anodes with constantly good anode potentials were obtained with whisker structures by standardization of the platinization process. It is concluded that the activity of the glycol anodes depends strongly on the procedure of deposition of the noble metals and less on the whisker structure as such.

Author (ESA)

**N82-14667#** Centre National d'Etudes Spatiales, Toulouse (France). Div. Stabilization Structures Thermique.

**MODAL ANALYSIS OF STRUCTURES WITH PRESTRESS EFFECTS: APPLICATION TO FLEXIBLE SOLAR GENERATORS [ANALYSE MODALE DE STRUCTURES AVEC EFFETS DE RECONTRAINTE. APPLICATION AUX GENERATEURS SOLAIRES SOUPLES]**

B. Boissin 20 May 1981 76 p refs In FRENCH
(CNES-81/CT/PRT/SST/SM/178) Avail: NTIS HC A05/MF A01

A model of the dynamic behavior of a flexible solar array which is part of a satellite-borne solar generator for spacecraft power supply (4 to 10kW) is presented. Results are appropriate for solving problems of spacecraft attitude control. The array is depicted as a skin covered by solar cells. Modal characterization of prestressed structures is explained for the calculation of differential rigidity. The method is demonstrated for a beam loaded at each end and for a square plate loaded along two opposite sides. Results for an array which is deployed along a telescoping mast are shown. Author (ESA)

**N82-14668#** Department of Agriculture, Washington, D.C. National Economics Div.

**SOLAR-SUPPLEMENTED, NATURAL AIR DRYING OF SHELLED CORN: THE ECONOMIC LIMITATIONS**

Walter G. Heid, Jr. and David F. Aldis Jun. 1981 45 p refs
(PB81-235681; TB-1654) Avail: NTIS HC A03/MF A01 CSCL 02C

It is not economically feasible to supplement natural air drying of high-moisture shelled corn by adding heat (solar and otherwise). In some cases, that drying method speeds product deterioration. A simulation analysis of the west central Great Plains determined that benefits from adding solar heat to batch-in-bin and layer-in-bin grain drying methods failed to offset the solar heat installation costs and product deterioration losses. Findings also suggest that high-speed, high-temperature drying is necessary to avoid field losses and to ensure marketable corn of high quality. GRA

**N82-14669#** National Weather Service, Salt Lake City, Utah.

**SOLAR RADIATION AS A SOLE SOURCE OF ENERGY FOR PHOTOVOLTAICS IN LAS VEGAS, NEVADA, FOR JULY AND DECEMBER**

Darryl Randerson Apr. 1981 23 p refs
(PB81-224503; NOAA-TM-NWS-WR-161; NOAA-81050702) Avail: NTIS HC A02/MF A01 CSCL 10B

Global radiation data represent the total direct solar radiation plus diffuse sky radiation received by a horizontal surface. The median, maximum, and minimum radiation days for both July and December are identified. In addition, the diurnal variation in the cumulative frequency distribution of the hourly global radiation data was graphed for both months. Based on photovoltaics, these charts are used to evaluate the expected solar energy supply for a given area of exposure. Example calculations are given to demonstrate how to find the total area of solar cells needed to supply the total energy demands of an all-electric home. T.M.

## 45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

**N82-14670#** Comptroller General of the United States, Washington, D.C.

**BILLIONS COULD BE SAVED THROUGH WAIVERS FOR COASTAL WASTEWATER TREATMENT PLANTS Report to the Congress**

22 May 1981 66 p refs
(CED-81-68) Avail: NTIS HC A04/MF A01

The effectiveness of the secondary treatment waiver provision to allow effluent discharge into marine coastal waters and its administration by the Environmental Protection Agency (EPA) in achieving desired levels of environmental quality in a practical and cost effective manner are studied. It is concluded that discharges of primary treated municipal wastes are not harmful to the marine environment and that giving waivers to coastal communities in these locations so that they do not have to build Federally required secondary treatment facilities could save billions of dollars. It is recommended that the Congress and EPA should reopen, modify, and continue the waiver application process. R.J.F.

**N82-14671#** Comptroller General of the United States, Washington, D.C.

**HAZARDOUS WASTE SITES POSE INVESTIGATION, EVALUATION, SCIENTIFIC, AND LEGAL PROBLEMS Report to the Congress**

24 Apr. 1981 74 p
(CED-81-57) Avail: NTIS HC A04/MF A01

The kind of scientific evidence necessary to determine whether or not a particular disposal site poses a significant hazard to the public's health is discussed. The capacity to collect and substantiate the kind of evidence required to prove the presence of a hazard or of a relationship between a disposal site and impaired health is discussed. Issues of legal liability, legislation, transportation of hazardous materials, and funding are also treated. R.J.F.

**N82-14672*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**APPLICATION OF A GAUSSIAN MULTILAYER DIFFUSION MODEL TO CHARACTERIZE DISPERSION OF VERTICAL HCl COLUMN DENSITY IN ROCKET EXHAUST CLOUDS**

G. L. Pellett and W. L. Staton Dec. 1981 74 p refs
(NASA-TP-1956; L-14715) Avail: NTIS HC A04/MF A01 CSCL 13B

Solid rocket exhaust cloud dispersion cases, based on seven meteorological regimes for overland advection in the Cape Canaveral, Florida, area, are examined for launch vehicle environmental impacts. They include a space shuttle case and all seven meteorological cases for the Titan 3, which exhausts 60% less HCl. The C(HCl) decays are also compared with recent in cloud peak HCl data from eight Titan 3 launches. It is stipulated that while good overall agreement provides validation of the model, its limitations are considerable and a dynamics model is needed to handle local convective situations. E.A.K.

**N82-14673*#** National Aeronautics and Space Administration, Washington, D.C.

**EFFECTS OF AIRCRAFT NOISE ON THE EQUILIBRIUM OF AIRPORT RESIDENTS: SUPPLEMENTARY ANALYSES TO THE STUDY CARRIED OUT AROUND ORLY**

J. Francois Sep. 1981 43 p Transl. into ENGLISH of "Repercussion du bruit des avions sur l'equilibre des reverains des aeroports--Analyses complementaires de l'enquete realisee autour d'Orly" Aug. 1977 42 p Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. Francais d'Opinion Publique, Paris
(Contract NASw-3542)
(NASA-TM-76627) Avail: NTIS HC A03/MF A01 CSCL 13B

The effects of aircraft noise on humans living near airports were studied. Two main questions were considered: do residents give evidence of psychological or physiological disturbances in unusually intense noise sectors; and do personality or health factors account for the high interindividual variability of annoyance? The methodology used and results obtained are presented. Samples of the survey questionnaires are included. E.A.K.

**N82-14674*#** National Aeronautics and Space Administration, Washington, D. C.
**TAKING INTO ACCOUNT NIGHTTIME ANNOYANCE IN THE CALCULATION OF THE PSOPHIC INDEX**
Jacques Francois May 1981 30 p ref Transl. into ENGLISH of "La Prise en Compte de la Gene Nocturne dans le Calcul de l'Indice Psophique" Rept., France, Feb. 1977 p 1-33 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Inst. Francaise d'Opinion Publique (IFOP), Paris
(Contract NASw-3199)
(NASA-TM-76580) Avail: NTIS HC A03/MF A01 CSCL 13B

The annoyance factor caused by air traffic noise on the residents of areas near airports is discussed. The psophic index is used to predict the level of overall annoyance suffered on the average by residents around airports. The calculation method differentiates between daytime and nighttime annoyance. E.A.K.

**N82-14675*#** National Aeronautics and Space Administration, Washington, D. C.
**ATTITUDES OF THE PEOPLE OF FRANCE TOWARDS THE SUPERSONIC BANG Final Report**
May 1981 77 p refs Transl. into ENGLISH of "Attitudes de la Population Francaise a l'Egard du Bang Supersonique" Rept. Centre d'Etudes et de Recherches Psychologiques Air de l'Armee de l'Air, France, Oct. 1971 p 1-91 Original language document was announced as A75-17371 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre d'Etudes et de Recherches Psychologiques Air de l'Armee de l'Air, Saint-Cyr-l'Ecole, France
(Contract NASw-3199)
(NASA-TM-76581) Avail: NTIS HC A05/MF A01 CSCL 13B

The attitudes and opinions of the people of France towards the supersonic boom were surveyed. The information provided answers to the following questions: (1) how does the boom rank among today's pollutants? (2) is perception of the boom objective? (3) does the frequency of exposure to the boom influence attitudes? (4) does sensitivity to the boom or annoyance from the boom increase linearly with the frequency? E.A.K.

**N82-14676#** Army Armament Research and Development Command, Dover, N. J.
**THE CHEMICAL CHARACTERIZATION OF POLLUTANTS IN WASTE WATER FROM VOLUNTEER ARMY AMMUNITION PLANT Final Report**
C. Ribaudo, C. Campbell, S. Bulusu, W. Fisco, T. Chen, H. Kramer, and T. Castorina Aug. 1981 61 p refs
(DA Proj. 1T7-62720-D-048)
(AD-A105705; AD-E400686; ARLCD-TR-81028) Avail: NTIS HC A04/MF A01 CSCL 13/2

The separation and identification of dissolved species and estimation of the concentrations of identified components are described. Inorganic pollutants were identified and estimated by spark source mass spectrometry and conventional wet chemical techniques. Organic pollutants were extracted from the waste waters with methylene chloride and the extracts were characterized by means of classical and multi-development thin-layer chromatography, gas chromatography, infrared spectrophotometry, mass spectrometry, and tandem gas chromatography mass spectrometry. The waste waters are shown to be exceedingly complex mixtures of nitroaromatic compounds derived from the TNT manufacturing process and heavy metal ions leached from the stainless steel reaction vessels. The concentration levels of many of the inorganic pollutants in the waste waters discharged into public waters exceeded the concentrations permitted by federal and state environmental pollution standards. T.M.

**N82-14677#** Sandia Labs., Albuquerque, N. Mex.
**BENEFICIAL USES OF NUCLEAR WASTE PROGRAM SEWAGE-SLUDGE IRRADIATION PROJECT Progress Report, Oct. 1980 - Mar. 1981**
R. W. Lynch, ed. Aug. 1981 96 p refs
(Contract DE-AC04-76DP-00789)
(DE82-000440; SAND-81-1695) Avail: NTIS HC A05/MF A01

The sewage sludge irradiation project which develops and transfers sludge irradiation technology to the municipal sector is discussed. Sludge irradiation is beneficial by reducing the pathogen content of sludge sufficiently to permit broad agricultural use without compromising public health and safety. A number of architect/engineer (A and E) firms are participating in the design, licensing, construction and start up of sludge irradiation plants. DOE

**N82-14678#** Argonne National Lab., Ill. Radiological and Environmental Research Div.
**RADIOLOGICAL AND ENVIRONMENTAL RESEARCH 1980: ECOLOGY Annual Report, Jan. - Dec. 1980**
Jul. 1981 131 p refs
(Contract W-31-109-eng-38)
(DE82-000154; ANL-80-115-Pt-3) Avail: NTIS HC A07/MF A01

Field grown and greenhouse grown soybeans are studied to determine the effects of sulfur dioxide, nitrogen dioxide, ozone, etc. on their crop yield. The effects of radioactive wastes on the Lake Michigan and its ecology are also studied. S.L.

**N82-14679#** Rockwell International Corp., Golden, Colo. Energy Systems Group.
**VOLUME REDUCTION OF USED HIGH-EFFICIENCY PARTICULATE AIR (HEPA) FILTERS**
O. I. Buttedahl, R. D. Howerton, ed., and M. Morales 3 Aug. 1981 15 p
(Contract DE-AC04-76DP-03533)
(DE81-028529; RFP-3132) Avail: NTIS HC A02/MF A01

A device to reduce the volume of used high efficiency particulate air (HEPA) filters from air filtration systems was constructed. A model of a three axis hydraulic compactor was developed for compacting 8 x 8 x 6 in. filters. It is demonstrated that HEPA filter volume reductions in excess of 90% can be achieved. A production model was built to accept Size 5 HEPA filters, which measure 2 x 2 x 1 ft. Use of the production model provides significant savings in both waste packaging and terminal waste storage. DOE

**N82-14680#** Oak Ridge National Lab., Tenn.
**COAL CONVERSION SOLID WASTE DISPOSAL**
C. W. Francis, W. J. Boegly, Jr., R. R. Turner, and E. C. Davis 1981 21 p refs Presented at the Am. Soc. of Civil Engr. Ann. Meeting, Vail, Colo., 3 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028567; CONF-81085-1) Avail: NTIS HC A02/MF A01

The major solid waste produced at coal conversion facilities will be gasification slag or ash. To evaluate the impact of this waste on the environment, extensive characterization and leaching studies were conducted on ash/slags that were generated in bench-scale operations, pilot plants, and/or process development units for the Cogas, British Gas/Lurgi, Grace/Texaco, U-Gas, Foster Wheeler/Stoic, SRC-I/Koppers-Totzek, SRC-II/Texaco, and Combustion Engineering gasification processes. These studies, designed to assess the consequences of disposal in landfills, showed that none of the leachates from these eight wastes exceeded the US Environmental Protection Agency's toxicity limits established as a result of the Resource Conservation and Recovery Act of 1976. The major environmental impact associated with disposal of these solid wastes appears to be the dissolution of sulfate and the potential acidification of ground water. DOE

**N82-14681#** Argonne National Lab., Ill.
**ENVIRONMENTAL ASSESSMENT AND INDUSTRIAL COGENERATION DEMONSTRATION PLANT AT THE HOFFMANN-LA ROCHE PLANT SITE, BELVIDERE, NEW JERSEY**
Jul. 1981 128 p refs
(Contract W-31-109-eng-38)
(DE81-030180; DOE/TIC-11487) Avail: NTIS HC A07/MF A01

The potential environmental, health and safety, and socioeconomic impacts of a proposed industrial cogeneration demonstration plant in Warren County, New Jersey was assessed. The proposed cogeneration system will produce steam for plant process operations. Impacts associated with the proposed action on topography and climatology, geology and soils, air quality, water resources and quality, ecological resources, socioeconomics, land

use plans and policies, health and safety, utilities and services, energy resources, and cultural resources and aesthetics are detailed. It is found that the potential environmental impacts from the proposed action, the operation of the proposed industrial cogeneration demonstration project on No. 6 fuel oil asits primary energy source will have no significant impact on the human and natural environments. Any potential environmental impacts will be mitigated by application of appropriate control technology and related measures. DOE

**N82-14682#** Institut de Recherche des Transports, Arcueil (France). Centre d'Evaluation et de Recherche des Nuisances et de l'Energie.

**PATTERNS OF BEHAVIOR IN LODGINGS SUBJECT TO TRAFFIC NOISE**

Jacques Lambert, Francois Simonnet, and Michel Vallet Sep. 1980 165 p refs In FRENCH; ENGLISH summary (IRT-47; ISBN-2-85782-075-5) Avail: NTIS HC A08/MF A01

Threshold values at which public services should intervene to attenuate the noise nuisance are defined. Observations were made in the field of daily life at home. Data were collected on the use of lodgings, on effects of noise on health and sleep, and on the incidence of running away from home. A correlation was also made with the equipment and noise insulation of lodgings. The results show that above 65 dB in daytime, there are behavior patterns that are extreme so far as they modify in a considerable manner the way of life of people, living both in collective housing (apartments) and in individual houses. Author (ESA)

**N82-14683#** Maine Univ. at Orono.

**REMOTE SENSING OF NON-POINT SOURCE SEDIMENT IN NORTHERN MAINE M.S. Thesis**

Rachel Sabena Smith May 1981 89 p refs Sponsored by Office of Water Research and Technology (PB81-233603; W81-04365; OWRT-A-049-ME(3)) Avail: NTIS HC A05/MF A01 CSCL 14B

Remote sensing techniques were used in connection with appropriate ground sampling to evaluate sediment loading caused by agricultural erosion. A two-year project was undertaken to develop and test procedures for quantitative monitoring of nonpoint source pollution in Aroostook County, Maine. The methodology developed has limited potential as a tool for detecting, quantifying and recording nonpoint source pollution due to low ambient turbidity levels and narrow stream widths. GRA

**N82-14684#** Walk, Hydel and Associates, Inc., New Orleans, La.

**LABORATORY STUDIES OF PRIORITY POLLUTANT TREATABILITY Final Report, Apr. 1978 - Mar. 1980**

James K. Smith, Robert J. Planchet, E. Jasper Westbrook, and Frederick J. Zak Jul. 1981 138 p refs (Contract EPA-68-03-2579) (PB81-231235; EPA-600/2-81-129) Avail: NTIS HC A07/MF A01 CSCL 13B

Several methods currently available to reduce the level of pollutants in an industrial plant wastewater stream were investigated. Five priority pollutants were selected for testing the effectiveness of carbon adsorption, resin adsorption, and steam stripping. The results indicate high removal efficiency for these five priority pollutants by carbon adsorption and resin adsorption. Although steam stripping reduced chlorobenzene, p-dichlorobenzene and nitrobenzene concentrations by at least fifty percent, it is not effective, under the test conditions, for the priority pollutants phenol or dinitrotoluene. Cost effectiveness may favor use of carbon adsorption over resin adsorption. T.M.

**N82-14685#** Industrial Environmental Research Lab., Research Triangle Park, N. C.

**PROCEEDING OF THE JOINT SYMPOSIUM ON STATIONARY COMBUSTION NOx CONTROL. VOLUME 1: NOx EMISSION USERS AND INVITED PAPERS**

Robert E. Hall and J. Edward Cichanowicz Aug. 1981 98 p refs Proceedings of Conf. held in Denver, 6-9 Oct. 1980 Sponsored in part by EPRI (PB81-236119; EPA-600/9-81-028A; IERL-RTP-1083A) Avail: NTIS HC A05/MF A01 CSCL 13B

Issues on stationary combustion and NOx emission were discussed. Main topics include: (1) utility boiler field tests; (2) NOx flue gas treatment; (3) advanced combustion processes; (4) environmental assessments; (5) industrial, commercial, and residential combustion sources; and (6) fundamental combustion research. GRA

**N82-14686#** Industrial Environmental Research Lab., Research Triangle Park, N. C.

**PROCEEDINGS OF THE JOINT SYMPOSIUM ON STATIONARY COMBUSTION NOx CONTROL. VOLUME 2: UTILITY BOILER NO SUB X CONTROL BY COMBUSTION MODIFICATION**

Robert E. Hall and J. E. Cichanowicz Aug. 1981 536 p refs Symp. held at Denver, 6-9 Oct. 1980 Sponsored by EPRI (PB81-236127; EPA-600/9-81-028B; IERL-RTP-1084a) Avail: NTIS HC A23/MF A01; also available in set of 5 reports HC A99 as PB81-236101 CSCL 13B

The use of combustion modification to control NOx emissions from utility boilers was discussed. Main topics include: utility boiler field tests; NOx flue gas treatment; advanced combustion processes; environmental assessments; industrial, commercial, and residential combustion sources; and fundamental combustion research. GRA

**N82-14687#** Industrial Environmental Research Lab., Research Triangle Park, N. C.

**PROCEEDINGS OF THE JOINT SYMPOSIUM ON STATIONARY COMBUSTION NOx CONTROL. VOLUME 3: UTILITY BOILER NO SUB X CONTROL BY FLUE GAS TREATMENT**

Robert E. Hall and J. Edward Cichanowicz Aug. 1981 277 p refs Proceedings of Conf. held in Denver, 6-9 Oct. 1980 Sponsored in part by EPRI (PB81-236135; EPA-600/9-81-028C; IERL-RTP-1085A) Avail: NTIS HC A13/MF A01 CSCL 13B

The treatment of flue gases from utility boilers to control NOx emissions are discussed. Main topics include: utility boiler field tests; NOx flue gas treatment; advanced combustion processes; environmental assessments; industrial, commercial, and residential combustion sources; and fundamental combustion research. GRA

**N82-14688#** Industrial Environmental Research Lab., Research Triangle Park, N. C.

**PROCEEDINGS OF THE JOINT SYMPOSIUM ON STATIONARY COMBUSTION NOx CONTROL. VOLUME 4: NOx CONTROL AND ENVIRONMENTAL ASSESSMENT OF INDUSTRIAL PROCESS EQUIPMENT, ENGINES, AND SMALL STATIONARY SOURCES**

Robert E. Hall and J. Edward Cichanowicz Aug. 1981 446 p refs Proceedings of the Conf. held in Denver, 6-9 Oct. 1980 Sponsored in part by EPRI (PB81-236143; EPA-600/9-81-028D; IERL-RTP-1086A) Avail: NTIS HC A19/MF A01 CSCL 13B

The NOx control and environmental assessment of industrial process equipment, engines, and small stationary sources are related. Main topics include: utility boiler field tests; NOx flue gas treatment; advanced combustion processes; environmental assessments; industrial, commercial, and residential combustion sources; and fundamental combustion research. GRA

**N82-14689#** Industrial Environmental Research Lab., Research Triangle Park, N. C.

**PROCEEDINGS OF THE JOINT SYMPOSIUM ON STATIONARY COMBUSTION NOx CONTROL. VOLUME 5: FUNDAMENTAL COMBUSTION RESEARCH AND ADVANCED PROCESSES**

Robert E. Hall and J. Edward Cichanowicz Aug. 1981 325 p refs Proceedings of Conf. at Denver, 6-9 Oct. 1980 Sponsored in part by EPRI (PB81-236150; EPA-600/9-81-028E; IERL-RTP-1087A) Avail: NTIS HC A14/MF A01 CSCL 13B

The NOx control and its application to combustion research and advanced processes is discussed. Main topics include: utility boiler field tests; NOx flue gas treatment; advanced combustion processes; environmental assessments; industrial, commercial, and residential combustion sources; and fundamental combustion research. GRA

# 46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

**N82-14690*#** California Univ., San Diego, La Jolla. Inst. of Geophysics and Planetary Physics.

**THE SEISMOTECTONICS OF PLATE BOUNDARIES Final Report, 1 Nov. 1973 - 30 Jun. 1981**

John Berger, James N. Brune, John Goodkind, Frank Wyatt, Duncan C. Agnew, and Christopher Beaumont (Dalhousie Univ.) 30 Jun. 1981 85 p refs

(Grant NGR-05-009-246)

(NASA-CR-165050) Avail: NTIS HC A01/MF A01 CSCL 08G

Research on the seismotectonics of plate boundaries is summarized. Instrumental development and an observational program designed to study various aspects of the seismotectonics of southern California and the northern Gulf of California are described. A unique superconducting gravimeter was further developed and supported under this program for deployment and operation at several sites. Work on Earth tides is also discussed. M.D.K.

**N82-14691*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**STRATOSPHERIC AEROSOLS**

M. Patrick McCormick Nov. 1981 20 p refs

(NASA-TM-83217) Avail: NTIS HC A02/MF A01 CSCL 04A

The current state of information on stratospheric aerosols is reviewed. Aerosol properties such as size, size distribution, composition, refractive index, number density, extinction, optical depth, and single scattering albedo are considered and generalized as much as possible to be representative of the global aerosol in times of volcanic and nonvolcanic (background) periods. Data are presented that show the global distribution of stratospheric aerosols as measured by the stratospheric aerosol and gas experiment (SAGE) satellite system for background and volcanic (post-Mount St. Helens) conditions. In addition, lidar and dustsonde data are presented that show the changes in stratospheric aerosol over an 8-year period. A.R.H.

**N82-14692#** Technische Hogeschool, Delft (Netherlands).

**GRAVITY WAVES ON WATER WITH NON-UNIFORM DEPTH AND CURRENT Ph.D. Thesis**

Nico Booij 19 May 1981 130 p refs

Avail: NTIS HC A07/MF A01

A mathematical model for the combined refraction-diffraction of linear periodic gravity waves on water is developed, in which the influence of inhomogeneities of depth and current is taken into account. The model is used to compute partial reflection of waves crossing a gully or an undersea slope, with influence of a current. The model is also applied to prismatic wave channels with reflecting side-walls. For a gully bounded by shallows the model predicts the decay of wave height due to radiation of energy in lateral direction. For practical application in regions with arbitrary bottom and current topography a parabolic approximation of the model is derived. This is used as a basis for numerical calculation of waves in a sea region near the coast. Author

**N82-14693*#** National Aeronautics and Space Administration, Washington, D. C.

**STUDIES ON THE BEHAVIOR OF AMMONIA AND AMMONIUM SALTS IN THE ATMOSPHERE (1) - FRACTIONAL COLLECTION OF AMMONIA GAS AND PARTICULATE AMMONIUM**

Kiko Kiin, Mosturu Fujimura, and Yoshikazu Hashimoto May 1981 10 p refs Transl. into ENGLISH from the Journal of the Japan Soc. of Air Pollution (Japan), v. 14, no. 10, 1979 p 30-33 Original language document was announced as A80-28118 Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76582) Avail: NTIS HC A02/MF A01 CSCL 04A

Methods for the fractional collection of trace amounts of atmospheric ammonia gas and ammonium particles on a two staged glass fiber filter are summarized. A standard glass fiber filter washed with distilled water and dried at 120 to 130 C was used. A second filter was impregnated with a mixture of 3% boric acid and 25% glycerin solution. The blank of glass fiber filters impregnated with a mixture of the above solution was very low for ammonia, i.e. 0.06 micrograms in a filter of 47 mm in diameter. The mean concentrations of ammonia and ammonium in air at Kawasaki, a polluted area, were 7.6 and 2.3 micrograms cu m, and those at Sanriku, an unpolluted area 0.9 and 0.2 micrograms cu m, respectively. Ratios of concentration levels of ammonium to total ammonia in the atmosphere were 0.3 and 0.2 for the polluted and unpolluted areas, respectively. Ammonium salts in air at both areas were not correlated with relative humidity. Variations in time of ammonia concentrations and sources in surrounding areas are also considered. M.D.K.

**N82-14694#** Institut fuer Astrophysik und Extraterrestrische Forschung, Bonn (West Germany).

**ON THE IDENTIFICATION OF PLANETARY-SCALE WAVES DURING DISTURBED CONDITIONS**

G. W. Proelss 1981 13 p refs In ENGLISH; GERMAN abstract

(ISSN-0340-9821; Rept-94) Avail: NTIS HC A02/MF A01

Thermospheric density variations previously interpreted as propagating gravity waves are investigated. These variations are primarily spatial in nature and are attributed to the quasi-stationary daytime geomagnetic activity effect. S.L.

**N82-14695#** Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.

**SINGLE CHANNEL SEISMIC EVENT DETECTION**

Robert R. Blandford, David Racine, and Raleigh Romine Alexandria, Va. VELA Seismological Center 7 Oct. 1981 153 p refs

(Contract F08606-79-C-0007; DARPA Order 2551)

(AD-A105469; SDAC-TR-81-7; VSC-TR-81-8) Avail: NTIS HC A08/MF A01 CSCL 17/10

Several types of seismic signal detectors were tested on NORSAR and Pinedale, Wyoming signals buried every 10 minutes in approximately 22 hours of phase scrambled noise. All plausible detectors including human analysts operate within 0.1 mb of the mean value including the present on-line 'IBM' STA/LTA detector, a 'Z' detector, detectors with fixed or optimum filters, a 'deflection' detector, the MARS detector, a detector which cascades a recursive digital filter with Walsh transforms, and human analysts viewing unfiltered Calcomp plots. The best detector was a log-Z transform aided by a recursively updated optimum sq(S/N) filter. Among the worst were human analysts when operating in the pick everything mode, the deflection detector, and a prediction error type detector. The human analyst could, however, improve to be nearly the best if sufficient care was taken. With a modest amount of care, any detector can be modified to perform well as an element of an operational system and the choice of single channel detector can be made on other grounds than pure detection such as availability or computation speed. In this report also we outline the features of the existing on-line detector at the SDAC which, in addition to pure detection, also classifies events as spikes, drop outs, regionals, and teleseisms and calculates a refined start time. Author (GRA)

**N82-14696#** Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.

**REGIONAL PHASE PROCESSORS**

Eugene Smart and Helene Sproules VELA Seismological Center 7 Oct. 1981 39 p refs

(Contract F08606-79-C-0007; Grant ARPA Order 2552)

(AD-A105470; SDAC-TR-81-1; VSC-TR-81-19) Avail: NTIS HC A03/MF A01 CSCL 17/10

The Smart processor technique and the propagation direction of regional seismic phases by operating on a comprehensive data set were evaluated. The Smart single station maximum likelihood surface wave processor relies on three component particle motion analysis, demonstrates its utility for automatic signal azimuth determination. The Smart processor maximizes

the ratio of energy between components. The P-wave azimuth is determined by minimizing the transverse component, the L(g) by maximizing the transverse and the emergence cycle by finding the best rectilinear motion fit to three components of data. The F-statistic computed by these processors serves to separate poor azimuthal estimates from the population. E.A.K.

**N82-14697#** Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.
**SOME OPTICAL PROPERTIES OF BLOWING SNOW Final Report**
Mary Ann Seagraves Jun. 1981 40 p refs
(DA Proj. 1L1-61102-B-53-A)
(AD-A103268; ASL-ERADCOM/ASL-TR-0091) Avail: NTIS HC A03/MF A01 CSCL 04/1

Windblown snow causes severe reduction in visibility and is a principal cause of obscuration in some regions of the world. Mechanisms of snow transport are presented along with particle size distributions, shape, and fall velocity. Relationships between visibility and windspeed and also between visibility and mass density in blowing snow are discussed. Variation of visible and infrared extinction coefficients with height were derived. T.M.

**N82-14698#** Fraunhofer-Inst. fuer Atmosphaerische Umweltforschung, Garmisch-Partenkirchen (West Germany).
**ATMOSPHERIC DUST AND AEROSOL STUDY Data Report, Mar. 1976 - Dec. 1978**
Reinhold Reiter, Hans Muller, and Rudolf Sladkovic Apr. 1981 57 p refs
(Grant DA-ERO-77-G-035; DA Proj. 1T1-61102-BH-57)
(AD-A100658) Avail: NTIS HC A04/MF A01 CSCL 04/1

Fluorescent particle tracer experiments were conducted to study the dispersion processes in the north-alpine Loisach River Valley for a variety of meteorological conditions including inversion cases. This report summarizes the details of the experiments and presents all results, in particular the particle concentrations measured at various downwind locations by H-shaped Rotorod samplers together with the relevant meteorological conditions, in tabular form. The report is intended to serve as a data base for further analysis. Author

**N82-14699#** Naval Research Lab., Washington, D. C. Plasma Physics Div.
**NONLINEAR EVOLUTION OF PLASMA ENHANCEMENTS IN THE AURORAL IONOSPHERE 1: LONG WAVELENGTH IRREGULARITIES**
M. J. Keskinen and S. L. Ossakow 5 Oct. 1981 32 p refs Sponsored in part by Defense Nuclear Agency
(RR0330244)
(AD-A105553; NRL-MR-4611) Avail: NTIS HC A03/MF A01 CSCL 04/1

The linear stability and nonlinear evolution of plasma enhancements in arbitrary ambient electric fields in the diffuse auroral F region ionosphere have been studied using analytical and numerical simulation techniques. Our results indicate that equatorward convecting plasma slabs initially limited in latitudinal extent are primarily destabilized on their poleward sides by a combination of the effects of convection and field aligned currents. Furthermore we find that the plasma enhancements break up into primary striation-like structures (elongated in the north-south direction for equatorward convection) which can form and cascade from large (approx. = 100 km) to smaller (approx. = 3 km) scale sizes on the order of an hour. The primary and associated smaller scale structures can be oriented either in the north-south or east-west (L-shell alignment) direction depending on the ambient electric field magnitude and direction. GRA

**N82-14700#** Naval Ocean Systems Center, San Diego, Calif.
**ELECTRO-OPTICAL ATMOSPHERIC TRANSMISSION EFFORT IN THE MARINE ENVIRONMENT Interim Report, 1978 - 1981**
Juergen H. Richter and Herbert G. Hughes 12 May 1981 52 p refs
(ZF599551002)
(AD-A105665; NOSC/TR-696) Avail: NTIS HC A04/MF A01 CSCL 20/3

This report reviews the Navy's effort and addresses accomplishments, status, and future plans in the electro-optical atmosphere transmission areas of systems performance modeling, climatologies, modeling of aerosol distributions, aerosol propagation effects, and instrumentation. The Navy's EO atmospheric transmission program has yielded significant results in the areas of systems performance assessment, worldwide climatologies, aerosol measurement and modeling, and instrumentation development. Future effort will continue in these areas, with an increased emphasis on development of instrumentation for the operational assessment of the propagation environment. GRA

**N82-14701#** Mission Research Corp., Santa Barbara, Calif.
**THE EFFECT OF MULTIBURST NO PRODUCTION ON ELECTRON DENSITIES AND HF ATTENUATION AT 60 KM ALTITUDE Final Report, 1 Dec. 1978 - 31 May 1980**
Murray Scheibe 1 Oct. 1980 30 p refs
(Contract DNA001-79-C-0089; S99QAXH)
(AD-A105676; MRC-R-584; DNA-5473F) Avail: NTIS HC A03/MF A01 CSCL 04/1

The effect of large scale production of NO due to a large number of nuclear bursts on the steady state electron densities at 60 km altitude was investigated. It was found, for ionization rates of 16 and 1600 ion-pairs/cubic cm-sec, that the electron densities decreased significantly below that expected for ambient conditions for NO concentrations greater than 10 to the 9th/cubic cm. Since this is the region of maximum HF attenuation, the effects of multiburst NO production on HF communication systems could also be significant. Further calculations are planned. Author (GRA)

**N82-14702#** Physical Dynamics, Inc., Bellvue, Wash.
**A COMPUTER MODEL FOR HIGH-LATITUDE PHASE SCINTILLATION BASED ON WIDEBAND SATELLITE DATA FROM POKER FLAT Final Report, 15 Aug. 1979 - 28 Feb. 1981**
Edward J. Fremouw and John M. Lansinger 28 Feb. 1981 55 p refs
(Contract DNA001-79-C-0372; DNA Proj. S99-QAXH)
(AD-A105620; PD-NW-81-240R; DNA-5686F) Avail: NTIS HC A04/MF A01 CSCL 04/1

A mathematical model has been developed for describing plasma-density irregularities responsible for radiowave scintillation produced in the auroral ionosphere, and the model has been committed to an applications-oriented computer code, WBMOD. The model characterizes the three-dimensional configuration, gradient sharpness, and height-integrated strength of irregularities represented by a power-law spatial spectrum as functions of geomagnetic latitude, time of day, sunspot number, and planetary geomagnetic activity index. Program WBMOD permits calculation of the power-law index and spectral strength (at a fluctuation frequency of 1 Hz) of phase scintillation, together with scintillation indices (variances) for phase and intensity, using a phase-screen scattering theory. The model has been calibrated and iteratively tested against phase-scintillation data from the DNA Wideband Satellite Experiment, collected at Poker Flat, Alaska. It does not account for seasonal variations in high-latitude scintillation observed in other longitude sectors. The program contains a model for middle-latitude and equatorial irregularities as well as for auroral latitudes, but only the latter has been tested extensively against high-quality scintillation data. Author (GRA)

**N82-14703#** Sandia Labs., Albuquerque, N. Mex.
**ANALYSIS OF DATE FROM LINE-SOURCE THERMAL-CONDUCTIVITY MEASUREMENTS TAKEN IN SITU IN DOME SALT AT THE IVERY ISLAND MINE**
D. F. McVey Aug. 1981 79 p refs
(Contract DE-AC04-76DP-00789)
(DE82-000517; SAND-81-1232) Avail: NTIS HC A05/MF A01

The thermal conductivity was determined to be 5.8 W/m-K at about 26 C and 5.6 W/m-K at about 31 C. Because the influence of contact resistance and two-dimensional effects prevented the temperature rise from attaining the log-time linear asymptote classically used to analyze line source probe data, a new data reduction procedure using parameter estimation techniques was developed. The procedure obtains a least-squares-best-fit of a classic line source integral solution to the non-linear early time temperature data. In the fit, contact resistance and thermal conductivity are free parameters. The technique removes

many of the classic assumptions that restrict the usefulness of line source probes for in situ measurements. T.M.

**N82-14704#** Battelle Pacific Northwest Labs., Richland, Wash.
**ASSESSMENT OF EFFECTIVENESS OF GEOLOGIC ISOLATION SYSTEMS: THE AEGIS GEOLOGIC SIMULATION MODEL**
M. G. Foley and G. M. Petrie Feb. 1981 17 p refs Presented at the Symp. on Uncertainties Assoc. with the Regulation of the Geol. Disposal of High-Level Radioact. Waste, Gatlinburg, Tenn., 9 Mar. 1981
(Contract DE-AC06-76RL-01830)
(DE81-028007; PNL-SA-9111; CONF-810372-11) Avail: NTIS HC A02/MF A01

Assessment of the post-closure performance of a nuclear waste repository has two basic components: the identification and analysis of potentially disruptive sequences and the pattern of geologic events and processes causing each sequence, and the identification and analysis of the environmental consequences of radionuclide transport and interactions subsequent to disruption of a repository. The AEGIS Scenario Analysis Task is charged with identifying and analyzing potenially disruptive sequences of geologic events and processes. The Geologic Simulation Model (GSM) was developed to evaluate the geologic/hydrologic system surrounding an underground repository, and describe the phenomena that alone, or in concert, could perturb the system and possibly cause a loss of repository integrity. DOE

**N82-14705#** California Univ., Berkeley. Lawrence Berkeley Lab. Dept. of Mechanical Engineering.
**DAYLIGHTING CALCULATIONS FOR NONRECTANGULAR INTERIOR SPACES WITH SHADING DEVICES**
M. F. Modest (Univ. of Southern California, Los Angeles) Jun. 1981 35 p refs Presented at Illuminating Engr. Soc. Ann. Tech. Conf., Toronto, 9 Aug. 1981
(Contract W-7405-eng-48)
(DE81-027962; LBL-12599; EEB-W-81-05; W-81; CONF-810862-1) Avail: NTIS HC A03/MF A01

Employing a general numerical model for the calculation of daylighting in interior spaces the sensitivity of daylighting to nonrectangular rooms, such as L-shaped rooms, and to other internal visual obstructions, such as light shelves, is discussed. Opaque, semitransparent, and translucent window overhangs, which may be positioned at any or all sides of a window are also treated. The model has the capability of graphical output. Results are shown in the form of contour plots, showing room outline, sunny areas, and constant illumination or constant daylight factor lines. DOE

**N82-14706#** California Univ., Berkeley. Lawrence Berkeley Lab. Energy Efficient Buildings Program Office.
**HEMISPHERICAL SKY SIMULATOR FOR DAYLIGHTING MODEL STUDIES**
S. Selkowitz Jul. 1981 6 p refs Presented at the 6th Natl. Passive Conf., Portland, Oreg., 8-12 Sep. 1981
(Contract W-7405-eng-48)
(DE81-028130; LBL-12967; CONF-810925-19; EEB-W-81-11; W-93) Avail: NTIS HC A02/MF A01

The design of a 24 foot diameter hemispherical sky simulator is described. A facility in which large models is tested, which is suitable for research, teaching, and design which could provide a uniform sky, an overcast sky, and several clear sky luminance distributions, as well as accommodating an artificial sun was produced. Initial operating experience with the facility is described, the sky simulator capabilities are reviewed, and its strengths and weaknesses relative to outdoor modelling tests are discussed. DOE

**N82-14707#** Midwest Research Inst., Golden, Colo. Measurement Research and Support Branch.
**ALL-SKY, VIDEO-BASED LUMINANCE MAPPER FOR DAYLIGHTING RESEARCH**
Theodore W. Cannon and Leo D. Dwyer Jul. 1981 5 p refs Presented at the 6th Natl. Passive Conf., Portland, Oreg., 8-12 Sep. 1981
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(DE81-029276; SERI/TP-643-1324; CONF-810925-20) Avail: NTIS HC A02/MF A01

A video based system for acquisition and luminance analysis of all sky and interior surface images are developed. The system uses an orthographic projection fisheye lens and transfer lens combination to produce an image of the entire sky dome on the camera's vidicon target. Video data for each image are digitized in real time to produce a field of data which is analyzed to produce meaningful measurements. The camera system is described and examples of all sky luminance mapping as well as application to interior surface mapping of daylighting models are presented. DOE

**N82-14708#** Los Alamos Scientific Lab., N. Mex.
**GEOLOGY AND GEOCHEMISTRY OF SAMPLES FROM LOS ALAMOS NATIONAL LABORATORY HDR WELL EE-2, FENTON HILL, NEW MEXICO**
R. Laney, A. W. Laughlin, and M. J. Aldrich, Jr. Jul. 1981 33 p refs
(Contract W-7405-eng-36)
(DE81-026068; LA-8923-MS) Avail: NTIS HC A03/MF A01

A method of extracting geothermal energy from rocks of low natural permeability was investigated. The deeper part of the Precambrian section at Fenton Hill, New Mexico is composed primarily of a very heterogeneous and structurally anisotropic metamorphic complex, locally intruded by dikes and sills of granodioritic and monzogranitic composition. In borehole none of the igneous bodies approach in size the 335 m thick biotite-granodiorite body encountered at 2591 m depth beneath Fenton Hill in the other two drill holes. Contacts between the igneous and metamorphic rocks range from sharp and discordant to gradational. It is indicated that clay rich alteration zones are relatively common in the openhole portion of EE-2. These zones average about 20 m in thickness. Slickensided fault planes are present in a core taken from a true vertical depth of 4195 m. It is suggested that the faults dip steeply and trend between N.42 deg and 59 deg E. DOE

**N82-14709#** Technische Universitaet, Brunswick (West Germany). Inst. fuer Nachrichtentechnik.
**SOUNDING ROCKET PROGRAM MAGNETOSPHERE: THE SEARCH COIL MAGNETOMETER EXPERIMENT IN THE SUBSTORM PHENOMENA PAYLOAD Final Report, Jun. 1980**
Guenther Dehmel and Burkhard Theile Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 51 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-81-010; ISSN-0170-1339) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 10.70

Single axis search coil magnetometers were in order to study plasma waves in the magnetosphere. The instruments are sensitive to magnetic field variations in the frequency range from 100 Hz to 5.2 kHz and complement the electromagnetic wave detector measurements. The sensor consists of a coil, a micro-metal core and a preamplifier. Analog amplifiers and filters are contained in the main electronics package. Electromagnetic interferences during payload tests are discussed. All four flights were successful, even though interferences during activation of the attitude control system deteriorated some data. The data are presented as amplitude-time diagrams and as spectra in the frequency range 200 Hz to 5 kHz (100 Hz bandwidth). Author (ESA)

**N82-14710#** Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France). Dept. PCE.
**EXPERIMENTAL STUDY OF INSTABILITIES AND MOTION OF A STREAMING IONOSPHERIC PLASMA IN THE POLAR ZONE [ETUDE EXPERIMENTALE DES INSTABILITES ET MOUVEMENTS DE DERIVE DU PLASMA IONOSPHERIQUE EN ZONE POLAIRE]**
Jacques Pignard Sep. 1979 119 p refs In FRENCH
(CRPE-NT-78) Avail: NTIS HC A06/MF A01

A space environment simulator was used in order to show the effect of plasma drift rate on the transfer impedance of a quadruple HF probe. Results allow for interpretation of the self oscillation frequency shift between the interferometric self oscillating probes onboard the sounding rocket experiment IPOCAMP 2. Data processing for the IPOCAMP 2 experiment, i.e. measurement of the electron density and of the continuous

(0 to 20 Hz) and alternating (10 to 200 Hz) electric fields, is explained. Physical parameters of the polar ionosphere were determined. Measurements contribute to a geophysical model of double band plasma instability observed in the E region of the auroral zone. Author (ESA)

**N82-14711** Iowa Univ., Oakdale.
**STRATIGRAPHY AND DEPOSITIONAL HISTORY OF THE IOLA LIMESTONE UPPER PENNSYLVANIAN (MISSOURIAN), NORTHERN MIDCONTINENT U.S. Ph.D. Thesis**
John Charles Mitchell 1981 379 p
Avail: Univ. Microfilms Order No. 8123341

The Iola Limestone, one of the best developed and most laterally extensive, yet least studied Missourian cyclic carbonates in the Midcontinent Upper Pennsyvlanian, was studied. Along with adjacent shales, five members constitute the Iola cyclothem, a typical Kansas cyclothem. In ascending order these are: Chanute Shale; Paola Limestone; Munice Creek Shale; Raytown Limestone; and Lane/Bonner Springs Shale. Although traditional interpretation of cyclothems regarded all shale as nearshore, shallow-water deposits, Iola lithology and stratigraphy support the more recent hypothesis that the cyclothem represents a single transgressive-regressive event, with maximum transgression occurring during deposition of the Muncie Creek Shale. Distribution of conodonts reflects the depositional pattern of the Iola cyclothem. Vertical variation far outweighs lateral variation in abundance and diversity. Dissert. Abstr.

**N82-14712** Iowa State Univ. of Science and Technology, Ames.
**A FINITE-ELEMENT SEA-BREEZE MODEL Ph.D. Thesis**
Lang-Ping Chang 1981 220 p
Avail: Univ. Microfilms Order No. 8123118

A two-dimensional finite element planetary boundary layer model was developed and successfully applied to the simulation of the sea-breeze phenomenon. The model solves the horizontal equations for conservation of momentum, the hydrostatic, the thermodynamic energy, and the continuity equations by the Galerkin finite element method. Profiles of the vertical exchange coefficients for momentum and heat are obtained from the O'Brien exchange-coefficient profile, together with Deardorff's formula for computing the height of the planetary boundary layer. The Coriolis effect is built in but the gradient of any quantity except for the synoptic-scale pressure in the alongshore direction is assumed to vanish. The synoptic pressure gradient is represented by the geostrophic wind relation and is assumed to stay steady during the integration process. A modified Crank-Nicholson time differentiating scheme is used to linearize the resulting algebraic system of equations in the iterative time integration process. Dissert. Abstr.

# 47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

**N82-14713#** Finnish Meteorological Inst., Helsinki.
**LIGHTNING FLASH COUNTER MEASUREMENTS IN FINLAND DURING 1978 AND 1979**
Leila Laitinen 1981 31 p refs In FINNISH; ENGLISH summary
(Rept-86; ISBN-951-697-135-0; ISSN-0355-1717) Avail: NTIS HC A03/MF A01

Lightning flash counter measurements in Finland are given. Transistorized counters were placed at weather stations throughout the country with the aim of finding the best measurement site for every counter in order to make the results as comparable as possible. Data are presented in the form of tables, graphs, and maps. R.J.F.

**N82-14714*#** National Aeronautics and Space Administration, Washington, D. C.
**MEASUREMENT OF CHARACTERISTICS OF LIGHTNING AT HIGH ALTITUDES Final Report**
M. Coquelet and D. Gall Dec. 1981 80 p Transl. into ENGLISH of 'Mesure des Caracteristiques de la Foudre en Altitude" Test No. 76/650000 P.4, Final Report, Toulouse, May 1979 74 p Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by CEAT
(Contract NASw-3541)
(NASA-TM-76669) Avail: NTIS HC A05/MF A01 CSCL 04B

New development in aeronautical technology -- the use of composite materials, new electronic components, electric flight controls -- have made aircraft potentially more and more vulnerable to the effects of lightning. In-flight tests were conducted to evaluate the current in a bolt of lightning, to measure voltage surge in the onboard circuitry and in certain pieces of equipment, and to document the relationship lightning bolt current and the voltage surge so as to develop a theoretical model and thuds to become acquainted with the significant T.M.

**N82-14715#** Technische Hogeschool, Delft (Netherlands).
**THE DIRECTIONAL ENERGY DISTRIBUTION OF WIND GENERATED WAVES AS INFERRED FROM STEREOPHOTOGRAPHIC OBSERVATIONS OF THE SEA SURFACE Ph.D. Thesis**
L. H. Holthuijsen 26 May 1981 198 p refs
Avail: NTIS HC A09/MF A01

Characteristics of the directional energy distribution of wind generated waves on the basis of observations with a relatively high resolution was determined. Approximately 75 observations are studied. They are selected from five spectra determined from stereophotographic observations of the sea surface. Three of these spectra were obtained in a so-called ideal generation situation. This is a situation where a homogeneous, stationary wind blows perpendicularly off a straight coast over deep water. The other two spectra were observed in similar situations. The difference with the ideal situation is for one spectrum that the wind was slanting across the coastline and for the other that the coastline was irregular. The observed distributions are compared with the model introduced by Longuet-Higgins et al. The differences between the observations and this model can be quantified due to the high resolution of the observations. It is found in the ideal situation that the model agrees well for most practical purposes with the observed distributions. In the other two situations it is found that the shape of the directional energy distribution is strongly influenced by the geometry of the upwind coastline. Author

**N82-14716#** European Space Agency, Paris (France).
**NOWCASTING: MESOSCALE OBSERVATIONS AND SHORT-RANGE PREDICTION**
B. Battrick, comp. and J. Mort, comp. Jun. 1981 427 p refs Symp. held in Hamburg, 25-28 Aug. 1981; sponsored by International Commission on Cloud Physics, International Association of Meteorology and Atmospheric Physics, WMO and COSPAR Original contains color illustrations
(ESA-SP-165; ISSN-0379-6566) Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Mesoscale weather systems, the analysis of observational data concerning mesoscale phenomena, and very short range weather forecasting based on mesoscale data are considered. For individual titles, see N82-14717 through N82-14781.

**N82-14717*#** Chicago Univ., Ill. Dept. of the Geophysical Sciences.
**MESOSCALE ASPECTS OF CONVECTIVE STORMS**
T. Theodore Fujita *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 3-10 refs (For primary document see N82-14716 05-47)
(Grants NGR-14-001-008; NA80AA-D-00001; NSF ATM-79-21260)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The structure, evolution and mechanisms of mesoscale convective disturbances are reviewed and observation techniques for 'nowcasting' their nature are discussed. A generalized mesometeorological scale is given, classifying both low and high pressure systems. Mesoscale storms are shown often to induce strong winds, but their wind speeds are significantly less than those accompanied by submesoscale disturbances, such as

tornadoes, downbursts, and microbursts. Mesoscale convective complexes, severe storm wakes, and flash floods are considered. The understanding of the evolution of supercells is essential for improving nowcasting capabilities and a very accurate combination of radar and satellite measurements is required. Author (ESA)

**N82-14718#** Purdue Univ., Lafayette, Ind. Dept. of Geosciences.

**MESOSCALE WEATHER PATTERNS DURING APRIL 10-11, 1979: SEVERE WEATHER OUTBREAK IN THE SOUTHWESTERN UNITED STATES**

Dayton G. Vincent, Thomas Q. Carney, Jeffrey Homan, and Richard Fulton *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 11-16 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Mesoscale weather patterns are diagnosed for a severe weather outbreak, using surface data and a special set of upper air observations taken as part of a severe environmental storms and mesoscale experiment. The upper air network was twice as dense as normal and observations were taken at three hourly intervals. Analyses show that prior to severe weather the surface pressure falls rapidly. The advent of thunderstorm activity is accompanied by strong upward motion, heavy precipitation and an intense upper, as well as developing middle level, tropospheric jet stream. There is a rapid increase in kinetic energy which appears to be linked to deep convection. Author (ESA)

**N82-14719#** Japan Meteorological Agency, Tokyo.

**MESOSCALE DISTURBANCES CAUSING A HEAVY SNOWFALL OVER THE COASTAL AREA OF THE SEA OF JAPAN**

H. Uemura *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 17-21 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Three types of mesoscale cloud systems causing heavy snowfall over the Sea of Japan, observed by meteorological satellites, are described. First, a band-shaped cloud system appearing under the intense winter monsoon, having a surface trough line along the west side of the Sea of Japan is considered. Centered along this line, a mesoscale vertical circulation system is revealed in the cold air under the inversion layer around the 700 mb level. Second, an arc-shaped cloud system, developing from the band-shaped system and characterized by anticyclonic circulation in the lower troposphere, is discussed. Third, a mesoscale cyclone with vertical cloud pattern, growing from a coupling between a stationary disturbance in the lower troposphere with a cold vortex moving eastward along the upper westerly current, is studied. The study of cloud system evolution permits the structural change to be understood. The 'nowcast' snow predictions allow a synoptic evaluation of the evolution. Author (ESA)

**N82-14720#** Japan Meteorological Agency, Tokyo.

**SUBSYNOPTIC SCALE CLOUD SYSTEM WHICH MOVES WESTWARD AND DEVELOPS OFF THE SOUTH COAST OF JAPAN**

Michio Hitsuma *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 23-28 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A cloud system revealed by satellite observations is described. After its formation, the system turned around and moved eastward, causing occasionally unexpected rain along the south coast of Japan. At first, the cloud system is identified as a simple band-shaped pattern and gradually grows into a hook or sea horse like pattern. There is a marked inversion layer at about the 700 mb level in the air mass including the cloud system and the cloud top height is confined below the layer. The cloud system develops when an upward motion area ahead of a synoptic scale upper trough approaches the system from the west. The westward motion and the development themselves were not analyzed and can not be predicted. Author (ESA)

**N82-14721#** Washington Univ., Seattle. Dept. of Atmospheric Sciences.

**MESOSCALE STRUCTURES IN MIDLATITUDE FRONTAL SYSTEMS**

Peter V. Hobbs *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 29-36 refs Sponsored by NSF, AFOSR, US Army Research Office and NOAA (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Observational studies of the dynamics, organization and structure of clouds and precipitation on the mesoscale in extratropical cyclones are reviewed. The regions of heaviest precipitation are generally organized into large mesoscale rainbands which are classified into six types: warm frontal, warm sector, wide cold frontal, narrow cold frontal, prefrontal cold surge, and postfrontal. Often, precipitation within the rainbands is further organized on the small mesoscale. Likely mechanisms for the large and small mesoscale organizations are identified. Author (ESA)

**N82-14722#** Yale Univ., New Haven, Conn. Dept. Of Geology and Geophysics.

**THE INFLUENCE OF MOUNTAINS ON THE ATMOSPHERE: RECENT ADVANCES**

Ronald B. Smith *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 37-41 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The theory and observation of orographic influence on the atmosphere are reviewed. The formation of orographic cirrus clouds, observations and theory of orographically disturbed surface pressure, the mechanism of severe downslope winds; orographic enhancement of precipitation; and lee cyclogenesis are discussed. Author (ESA)

**N82-14723#** Meteorological Office, Bracknell (England).

**MESOSCALE STUDIES OF WEATHER HAZARDS TO AVIATION**

W. T. Roach *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 43-47 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Mesoscale studies on the forecasting of aviation weather hazards, such as fog, icing, wind shear, and clear air turbulence (CAT), are reviewed. Mesoscale observations of the boundary layer were obtained by the deployment of minisondes at outstations. They are shown to have potential for improving the local forecasting of fog and cloud layer. The feasibility of operating a wind shear warning service and the representativeness of the wind data given by air traffic control to pilots about to land or take off are assessed. A regression analysis is presented and used to identify the combination of meteorological parameters determining CAT. Preliminary tests indicate success in forecasting CAT. Author (ESA)

**N82-14724#** National Oceanic and Atmospheric Administration, Washington, D. C. Nationale Earth Satellite Service.

**ANALYSIS OF RAINFALL FROM FLASH FLOOD PRODUCING THUNDERSTORMS, USING GOES DATA**

Roderick A. Scofield *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 51-58 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The use of the Scofield-Oliver GOES technique for estimating convective precipitation from flash flood producing thunderstorms is discussed. The technique is applied using imagery displayed with a digital enhancement curve. Estimates of convective rainfall are done by comparing the changes in two consecutive pictures, both infrared and high resolution visible. The method is applied to two flash flood events. The estimates as compared to the observed rainfall are good. However, a warm top modification is needed for thunderstorms whose expected anvil temperatures are warmer than -62C. Author (ESA)

**N82-14725#** Japan Meteorological Agency, Tokyo.
**INFRARED PARAMETERS FOR NOWCASTING SEVERE RAINSTORMS**
H. Yamashita, Y. Miki, N. Shibata (Meteorological Satellite Center), and N. Shimizu (Meteorological Satellite Center) *In* ESA Nowcasting: Mesoscale Observations and Short-Range Predictions Jun. 1981 p 59-62 (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The relation between convective cloud cluster and the resultant rainfall intensity was studied in order to establish a quantitative vector for information on severe convective clouds outside the radar network of local weather services. Two cases are considered. First the activity of a distant cloud cluster is quantified by the product of the standard deviation of the equivalent blackbody temperature (TBB) and the cloud cover percentage as established in coarse mesh satellite observations. This product is shown to be a good indicator for the mean rainfall rate. Second, the relation between TBB and rainfall rate in small scale areas is established, using echo maps of radar to draw isotherms of TBB in fine meshes. The colder cloud area enclosed by the isotherm of 230 K is shown to be important for the nowcasting of severe rainstorms. Author (ESA)

**N82-14726#** Meteorological Office, Bracknell (England).
**IMPROVEMENT OF HUMIDITY ANALYSES BY DIRECT USE OF METEOSAT WATER VAPOUR CHANNEL RADIANCES**
J. R. Eyre *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 63-66 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Satellite measured radiances are compared with radiances simulated from initial estimates of atmospheric temperature and humidity fields. The calculated differences used to improve the analyses of those fields are given. This approach was applied to the analysis of humidity in the middle and upper troposphere, using Meteosat water vapor channel data. Results show that a significant gain in structure can be achieved and that few iterations are needed. Author (ESA)

**N82-14727#** University Coll., London (England). Lab. for Planetary Atmospheres.
**A STUDY OF SUMMER THUNDERSTORMS DEVELOPING OVER EUROPE USING METEOSAT**
N. R. Ward and R. W. Saunders *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 67-72 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The growth of summer thunderstorms over Europe is studied, using color-sliced sequential infrared images from METEOSAT which were Mercator projected. The images were processed and analyzed, using an interactive planetary image processing system (IPIPS). Upper level winds derived from tracking clouds and suitably enhanced water vapor features agree well with radiosonde winds. Vertical fluxes of mass and latent heat were measured from the expansion of the storm tops, and the fluxes of the largest storms are found to be of comparable magnitude to some tropical storms. The applicability of a system such as IPIPS, in conjunction with images from a geostationary satellite, to nowcasting is demonstrated. Author (ESA)

**N82-14728*#** Maryland Univ., College Park. Dept. of Meteorology.
**TRANSFER AND DISTORTION OF ATMOSPHERIC INFORMATION IN THE SATELLITE TEMPERATURE RETRIEVAL PROBLEM**
Owen E. Thompson *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 73-76 refs (For primary document see N82-14716 05-47)
(Grant NSG-5209)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (20% others) CSCL 04B

A systematic approach to investigating the transfer of basic ambient temperature information and its distortion by satellite systems and subsequent analysis algorithms is discussed. The retrieval analysis cycle is derived, the variance spectrum of information is examined as it takes different forms in that process, and the quality and quantity of information existing at each stop is compared with the initial ambient temperature information. Temperature retrieval algorithms can smooth, add, or further distort information, depending on how stable the algorithm is, and how heavily influenced by a priori data. Author (ESA)

**N82-14729*#** Maryland Univ., College Park. Dept. of Meteorology.
**SATELLITE TEMPERATURE SOUNDINGS: MICROWAVE SATELLITE OBSERVATIONS**
Sigmund Fritz *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 77-81 refs Sponsored in cooperation with National Environmental Satellite Service (For primary document see N82-14716 05-47)
(Grants NsG-5209; NA80AA-D-00035)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 04B

Tiros satellite microwave measurements together with radiosonde data are used to illustrate a method for deriving vertical temperature distributions in the atmosphere on the scale of 100 km. The method employs N equations in N unknowns. The unknowns are the N coefficients which are needed at each pressure level to multiply the measured N radiances in order to retrieve the vertical temperature distributions. As an example, the spatial variation of the tropopause characteristics is derived over a cyclone. Diurnal variations in the radiances and the consistency of radiosondes and satellite radiance data need further investigation. Author (ESA)

**N82-14730#** Central Inst. for Weather Forecasting, Budapest (Hungary).
**STRUCTURE FUNCTION ANALYSIS OF NIMBUS 5 SCR DATA AT THE MESOSCALE**
G. Molnar *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 83-87 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A statistical structure function analysis of infrared satellite radiances, recorded by the selective chopper radiometer on Nimbus 5, is presented and its prospects for nowcasting purposes are assessed. From analysis of daily, lower tropospheric structure functions preceded by a noise level determination, a reasonably clear delineation is obtained between meteorologically active and nonactive days, regarding thunderstorm activity. An acceptable prediction of the occurrence of subsequent convective activity is shown possible. The results indicate that these structure functions lead to threshold values in terms of radiance, e.g., temperature gradients for nowcasting of certain types of convective activity. Author (ESA)

**N82-14731#** Australian Numerical Meteorology Research Center, Melbourne.
**THE USE OF DIRECT READOUT TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) DATA FROM TIRON N AND NOAA 6 SPACECRAFT TO STUDY A CUT-OFF LOW AND ASSOCIATED MESOSCALE COLD POOLS**
G. A. Kelly, B. W. Forgan, P. E. Powers, and J. LeMarshall (Bureau of Meteorology, Melbourne) *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 89-98 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The capabilities offered by the high horizontal resolution of TOVS soundings for the analysis of mesoscale systems are illustrated by a detailed account on the evolution of a cut-off low and associated cold pools developing over southern Australia. The observations and retrieval analyses include cloud imagery, 1000 to 500 mb thickness analyses, temperature analyses using infrared and microwave soundings, geopotential heights, geostrophic winds, and temperature wind and potential temperature wind cross sections. In view of the successful implementation, TOVS data are routinely used. Author (ESA)

**N82-14732#** Technische Universitaet, Hanover (West Germany). Inst. fuer Meteorologie und Klimatologie.

**TOPOCLIMATOLOGICAL MEASUREMENTS AT BIELEFELD AND ITS SURROUNDINGS AS AN EXAMPLE OF MESOSCALE OBSERVATIONS**

H. Bangert and A. Witting (Gesamthochschule Paderorn, West Germany) *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 101-107 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The topoclimatological differences in Bielefeld-West were collected from point data and line data records of ground stations in order to investigate the possibility of frost forecasting. Air temperature and relative humidity were collected continuously during six months at 11 fixed stations by means of a mobile unit. Although local topology as well as the prevailing weather conditions are shown to be responsible for temperature differences of up to 10 K between the daily practice stations and the surrounding area, advance frost warning proves possible from a combination of minimum temperature prediction and the knowledge of the expected night weather. Author (ESA)

**N82-14733#** Institute of Meteorology and Water Management, Podlesna (Poland).

**ON THE COMPLEX CONTROL METHOD**

Jan Parfiniewcz *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 109-110 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A retrieval procedure for erroneously rejected information is presented. A two stage scanning method for qualitative data control using a decision algorithm based on the chi-square test which allows for classifying error types is described. Although the method was mainly verified on aerological data, its extension to other types of meteorological data is straightforward.

Author (ESA)

**N82-14734#** Air Force Geophysics Lab., Hanscom AFB, Mass. Mesoscale Forecasting Branch.

**AUTOMATED AIRFIELD CLOUD OBSERVATION AND PREDICTION**

Donald A. Chisholm, Edward B. Geisler, and James C. Weyman *In* ESA Nowcasting: Mesoscale Observations and short-range Prediction Jun. 1981 p 111-114 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The processing of rotating beam ceilometer (RBC) output was automated by application of microprocessor technology. The method comprises: (1) small dot matrix display of each RBC scan after evaluation, validation and smoothing; (2) objective cloud base height determination used in an hierarchical clustering algorithm to define cloud observation; and (3) short range prediction through the application of statistical methods. Specification and prediction test results and comparisons are presented. Application of the developed capability as an aid to the weather observer/forecaster or as a fully automated component of a remote or unmanned weather support unit is advocated. Author (ESA)

**N82-14735#** Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.

**A TOTAL SYSTEM APPROACH TO A WEATHER RADAR NETWORK**

K. A. Browning *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 115-122 refs Original contains color illustrations (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Members States, AU, CN and NO (+20% others)

The operational use of radar data for real time surveillance and short period forecasting of surface rain is discussed. A system is outlined which provides analyzed actual rainfall patterns and hourly forecast rainfall for 1 to 6 hours ahead over a large area, using data from a network of radars. Analytical procedures designed to cope with the intrinsic error characteristics of weather radar are described. Interpretation of radar data within a wider meteorological context, using an advanced man computer interactive image display system is judged of prime importance. The approach is presented as a radical departure from traditional methods of dealing with radar data. Author (ESA)

**N82-14736#** National Center for Atmospheric Research, Boulder, Colo.

**NOWCASTING APPLICATIONS OF DOPPLER RADAR**

James W. Wilson and Kenneth E. Wilk (National Severe Storms Lab., Norman, Okalahoma) *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 121-134 refs Sponsored in part by NSF Original contains color illustrations (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Applications of Doppler radar, color displays and interactive graphical techniques for nowcasting and short period forecasting are presented. Specific examples of weather phenomena (clear air, widespread precipitation and convective precipication) are shown with special emphasis on Doppler velocity measurement. They include: (1) vertical profiles of the horizontal and vertical wind, and divergence and deformation of the horizontal component; (2) wind shift lines; (3) horizontal divergence fields; (4) gust fronts and downbursts; (5) tornadoes; (6) wind shear and turbulence hazardous to aircraft; and (7) precipitation and rate. Intensive man machine interaction is needed to derive Doppler radar products, whereby the nowcaster must be capable of integrating Doppler, satellite, surface and upper air data and be highly skilled in mesoscale forecasting. Author (ESA)

**N82-14737#** National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

**GROUND BASED REMOTE SENSING FOR METEOROLOGICAL NOWCASTING**

C. Gordon Little *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 135-142 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Ground-based remote sensors for monitoring middle and upper atmospheric parameters are discussed. These are: (1) optical scintillation devices for the measurement of transverse wind and precipitation; (2) acoustic echo sounding systems for monitoring the height of low level temperature inversions, boundary layer wind, and turbulence profiles; (3) optical radar infrared, and radio systems for monitoring drainage winds, gust fronts, boundary layer wind, turbulence profiles, and aerosol distributions; and (4) clear-air Doppler radar and multichannel microwave radiometry for measurements of vertical wind profiles, temperature, and humidity up to tropopause heights. The potential advantages of remote sensors over equivalent arrays of in situ sensors are stressed. Author (ESA)

**N82-14738#** Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).

**THE CAPABILITIES OF VHF RADAR FOR METEOROLOGICAL OBSERVATIONS**

J. Roettger *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 143-148 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A VHF radar system applying the spaced antenna drifts method is proposed for real time provision of relevant meteorological information. Examples obtained with the SOUSY VHF radar are discussed include: (1) measurements of tropospheric and stratospheric wind profiles; (2) the radar determined tropopause; (3) structure of a frontal system, including observations of stability, vertical velocity and short-term horizontal velocity variations due to thermal winds; (4) the detection of turbulence layers. It is stressed that this information can represent a considerable contribution for nowcasting purposes. Author (ESA)

**N82-14739#** Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Service d'Aeronomie.

**LIDAR MONITORING OF THE TROPOSPHERIC WATER VAPOR MIXING RATIO**

C. Cahen, G. Megie, and P. Flamant (Ecole Polytechnique, Palaiseau, France) *In* ESA Nowcasting: Mesoscale Observations

and Short-Range Prediction Jun. 1981 p 149-152 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Lidar measurements of the water vapor mixing ratio in the troposphere were performed, using the differential absorption laser technique. Vertical profiles are retrieved up to 9 km with a relative accuracy better than 15% for an integration time of a few minutes. Comparisons with local radio soundings (44 deg N, 5 deg S) show good agreement between the two techniques. This method allows continuous monitoring of the water vapor profiles over long observational periods. Author (ESA)

**N82-14740#** South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
**THE ROLE OF MESOSCALE SURFACE MOTIONS IN THE LIFE OF A CONVECTIVE STORM IN A DRY CONTINENTAL CLIMATE**
Andre A. Doneaud, James R. Miller, David L. Priegnitz, and Thomas Engel (Dept. of Natural Resources and Conservation, Miles City, Mont.) *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 155-160 refs (For primary document see N82-14716 05-47)
(Contract DI-8-07-83-V0009)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The role of surface wind and moisture fields in the formation of a convective storm is examined in association with synoptic scale perturbations. In order to get a better understanding of the coupling mechanism between the synoptic and mesoscale phenomena in the development of convective cloud systems, a mesoscale surface network system supported by 5 cm radar was used to observe the atmosphere at short intervals in time and space. Results show that for the storm analyzed, frontal passage plays a principal role in the formation of precipitating cells. The surface mesoscale fields of divergence and vorticity provide an estimate of storm mass and moisture transports, while the surface field of deformation provides an estimate of the superimposed frontal effect. The average size and magnitude of moisture convergence and the storm efficiency are identified as potential predictors for the total amount of rainfall. Author (ESA)

**N82-14741*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Dept. of Environmental Sciences.
**THE ROLE OF NEAR SURFACE OUTFLOW IN MAINTAINING CONVECTIVE ACTIVITY**
M. Garstang (Virginia Univ.) and H. J. Cooper *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 161-167 refs Sponsored in cooperation with Dept. of Army (For primary document see N82-14716 05-47)
(Grant NSF ATM-78-08865)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 04B

Continuous measurements of horizontal velocity, temperature and humidity at the surface over a dense network of stations were used to examine the behavior, at the surface, of a large number of convective storms. Feedback between storm outflow at the surface and the generation of convective cells is demonstrated. The outflow is shown in the surface divergence fields once rain begins, with characteristics common to storms in distinctly different meteorological environments, such as summertime Florida and Illinois. This commencement precedes the occurence of rainfall and radar echo in the location of the cell by some tens of minutes up to more than 100 mins. Given surface measurements with a spacing of no more than 10 km, the direction of propagation, timing of the future occurence of rainfall and the intensity of the rainfall generated in the cell can be determined. Author (ESA)

**N82-14742#** High Mountain Geophysical Inst., Nalchik (USSR).
**FORECAST OF SEVERE HAIL PROCESSES**
L. M. Fedchenko and V. A. Belenstsova *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 169-172 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The parametrical dependence of hail formation and hail growth was studied experimentally by radiosondes, radar and satellite as well as statistically. A graphical method for dangerous hailfall forecast is proposed in which thermodynamic conditions in the hail formation and growth region, subcloud layer energetic potential, frontal surface characteristics, and transport in the midtroposphere are quantitatively taken into account. Provided a detailed monitoring of the subcloud layer in the lower troposphere is available, the proposed method allows for forecasting severe hailfall events. Author (ESA)

**N82-14743#** Central Inst. for Atmospheric Physics, Budapest (Hungary).
**SHORT RANGE PREDICTION OF PRECIPITATION**
T. Taenczer *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 173-175 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Forecasts of average precipitation in a mesoscale region, having a 200 km diameter, 6 to 18 hours ahead are presented. A statistically established relation between the air state and the rainfall data is used in a 12 hour extrapolation of the air state. The wind run is computed on the actual 700 mb contour chart. The air state itself is characterized by eight parameters or predictors which include geostrophic vorticity, a moisture index derived from satellite images, and an instability index. Results show a correlation coefficient between forecasted and actual precipitation data of 0.55 with a maximum error in the forecasting of dry weather. The limitations of the methods are discussed and possible extensions are indicated. Author (ESA)

**N82-14744#** Washington Univ., Seattle. Dept. of Atmospheric Sciences.
**THE USE OF A SINGLE DOPPLER RADAR IN SHORT RANGE FORECASTING AND REAL TIME ANALYSIS OF EXTRATROPICAL CYCLONES**
Thomas J. Matejka and Peter V. Hobbs *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 177-182 refs Sponsored by NSF, AFOSR, U.S. Army Research Office and NOAA Original contains color illustrations (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A basis for interpretation and analysis of radar data on cyclones is derived and illustrated as a tool for nowcasting. The structure of extratropical cyclones is described, following the Norwegian cyclone model supplemented with a mesoscale cyclonic structure for the frontal organization, the horizontal precipitation pattern, and the structure of rainbands. Using these models, it is shown that forecasting warm frontal passages is possible by observing the decreasing height of the warm frontal surface aloft and by measuring the advancing region of fairly uniform post warm frontal winds at low levels. The cold frontal zone aloft, behind the passage of a cold front, is manifest in Doppler radar velocity scans at elevations greater than 6 deg as a layer in which the wind direction backs strongly with increasing height. It is expected that Doppler radar techniques can considerably further insight into the mesoscale structure of weather systems. Author (ESA)

**N82-14745#** McGill Univ., Montreal (Quebec). Stormy Weather Group.
**COMBINING SATELLITE AND RADAR DATA FOR THE SHORT RANGE FORECASTING OF PRECIPITATION**
G. L. Austin *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 183-192 refs Sponsored by Atmospheric Environment Service and Natural Sciences and Engineering Research Council of Canada (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

An algorithm was developed that yields the probability of rain in an area of 2000 x 1500 km from visible and infrared GOES satellite imagery and simultaneous radar data. The satellite image was mapped by means of a conic projection on a constant resolution cartesian grid to facilitate overlay with synoptic charts. A pattern recognition technique was then applied to 16 subareas of the entire map to track the displacement of the probability

of rain contours on maps taken 1 hour apart. Results indicate that the absence of easily recognizable features or a too high coverage percentage can lead to erratic motion; suitable criteria for rejection need to be introduced. The displacements of rain zones can be successfully forecasted. The trajectories of these rain areas correlate well with 700 mb wind. Author (ESA)

**N82-14746#** Air Force Geophysics Lab., Hanscom AFB, Mass. Mesoscale Forecasting Branch.

**SIMPLE SHORT RANGE MODELS USING SATELLITE IMAGERY DATA**

H. S. Muench *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 193-197 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 120 Member States, AU, CN and NO (+20% others)

A simple model was developed, using GOES satellite imagery to make short range cloud and precipitation forecasts. The method treats imagery parameters, such as cloud reflectivity and thermal emission, as conservative and predicts future values by means of motion vectors. Algorithms, relating these parameters to cloud amount and precipitation probability, give the forecasts. Motion vector tests, conversion algorithms, and test forecasts are described. Results show that the forecasts are 20% to 40% better than persistence at 4 to 6 hours, but have weak performance at short periods because of specification errors. More complexity must be built into future models. Author (ESA)

**N82-14747#** Japan Meteorological Agency, Tokyo.

**COMBINED USE OF RADAR WITH MESOSCALE SURFACE NETWORK FOR VERY SHORT RANGE PREDICTION OF PRECIPITATION**

Ryozo Tatehira, Yoshihisa Makino, and Michio Hitsuma *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 199-200 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A method for very short range forecasting of rainfall with radar data was developed. The method consists in extrapolating the initial digitized echo pattern, using the advection of 700 mb winds, followed by time integration and multiplication by calibration coefficients obtained comparing echo intensity with rain gage data. Results show that the predictions are 40% better than persistence. In order to improve the accuracy, it is suggested that the extrapolation procedure be improved by utilizing the surface wind field analyzed in a dense surface network. Combined use of radar and a surface network is proposed. Author (ESA)

**N82-14748#** Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.

**OBJECTIVE RAINFALL FORECASTING USING DATA FROM THE UNITED KINGDOM WEATHER RADAR NETWORK**

C. G. Collier *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 201-206 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A procedure for forecasting rainfall was developed for use with data derived from a radar network. Forecasting is based on the identification of radar echoes, using a single linkage clustering technique, and the linear extrapolation of objectively derived motion vectors. The data and algorithms used are described and the accuracy of forecasts up to 6 hours ahead together with the contribution of various errors to the overall performance of the procedure are analyzed. Ways of improving the forecasts, using objective techniques at the radar sites together with subjective quality control implemented at the network center, are proposed. Author (ESA)

**N82-14749#** Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.

**THE USE OF CLIMATOLOGICAL AND SYNOPTIC DATA FOR FORECASTING OROGRAPHIC ENHANCEMENT OF RAINFALL**

F. F. Hill and K. A. Browning *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 207-212 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A method is presented that applies mountain induced climatological enhancement fields to rainfall analyses and forecasts from radar and other data. A simplified orographic climatology was derived for England and Wales which is discussed in relationship with the physical mechanisms responsible for orographic rain. The fields of enhancement are held in computer as look-up tables, categorized as a function of synoptic parameters, such as low level wind velocity and humidity. After a selection by the forecaster of the appropriate synoptic category, the computer then automatically applies the enhancement to the rain forecasts derived by extrapolation of the radar rainfall pattern. The limited warning of rapidly approaching rain provided by coastal radar and the uncertainties in the forecast of low level humidity are identified. Author (ESA)

**N82-14750#** Szolgalat Meteorological Organization, Budapest (Hungary).

**USE OF PRECIPITATION MEASUREMENTS BY RADAR IN SHORT RANGE FORECASTING OF PRECIPITATION**

E. Bodolai-Jakus *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 213-219 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A diagnostic procedure and a forecasting method for mesoscale precipitation structures is described and applied to instability lines of the precipitation system of two regional cyclones and of the precipitation band at the periphery of an anticyclone. The translation speed of 30 linearly arranged precipitation systems allowed their speed of movement to be determined, for the pseudofront of the mesosystem constituted by the echoes, and not by the individual (even intense) isoechoes. Author (ESA)

**N82-14751#** Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

**THE USE OF MESOSCALE METEOROLOGICAL AND CLIMATOLOGICAL INFORMATION IN NOWCASTING AND SHORT RANGE PREDICTION**

Roger A. Pielke *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 223-229 refs Sponsored by NSF (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Mesoscale atmospheric phenomena affecting nowcasting, efficient modeling in forecasting, and of procedures capable of improving dissemination of nowcast information are reviewed. A distinction is made between terrain-forced mesoscale systems, which are amenable to accurate predictions, and synoptically-forced mesoscale systems generated by highly variable synoptic circulation. Specific examples are shown of terrain-forced systems which demonstrate that even for these systems current procedures for disseminating forecast information are inadequate. Upgrading of forecasts through large scale modeling is advocated along two lines: mesoscale integration from initial and boundary conditions established one or more times daily, or archiving of typical synoptic situations with parametric classification. Procedures to improve the distribution of mesoscale information are suggested. Author (ESA)

**N82-14752#** Meteorological Office, Bracknell (England).

**A MESOSCALE FORECAST FOR 25 AUGUST 1975: THE HAMPSTEAD STORM**

M. J. Bailey, K. M. Carpenter, L. R. Lowther, and C. W. Passant *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 231-236 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A three-dimensional numerical atmospheric model was used to obtain a forecast for the afternoon when an intense stationary multicell storm formed over London and produced extensive flooding. Whether early warning of that event was possible is discussed. Starting from synoptic surface pressure analysis and radiosonde ascent data, a finite difference evolution computation was carried out, involving the nonhydrostatic compressible equations of motion on a three-dimensional grid. The forecast

shows a well defined area of convergence at the right place, but about 4 hours later than the actual storm. Possible explanations for this discrepancy are put forward. Shading by an observed layer of medium level cloud has an important effect on the forecast. Author (ESA)

**N82-14753#** Royal Netherlands Meteorological Inst., De Bilt.
**DESCRIPTION OF AN ADVECTIVE BOUNDARY LAYER MODEL USING TRAJECTORIES**
D. Blaauboer, H. A. R. deBruin, J. Reiff, and A. P. vanUlden *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jul. 1981 p 237-239 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

For short range forecasting purposes, a model of the atmospheric boundary layer (BL) was developed, including exchange of heat and water vapor at the Earth surface, entrainment at the top of the BL, and taking horizontal advection into account with a trajectory model. The evolution of temperature and height of the BL is discussed for both stable and unstable boundary layers and composed with measurements. Although the preliminary simulation results are encouraging, it is not shown whether advection is important. Further improvements are indicated. Author (ESA)

**N82-14754#** Royal Netherlands Meteorological Inst., De Bilt.
**SHORT RANGE PREDICTION OF CLOUDS USING TRAJECTORIES**
P. W. Rosier, J. Reiff, C. J. vanderGoot, and A. Steenhuisen *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 241-243 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Temperature and humidity profiles for 24 hours forecasting, obtained by reconstruction of the source areas of inflowing air with a trajectory method are discussed. The procedure involves wind direction prediction and trajectory derivation for the 300, 500, 850, and 1000 mbar levels and analysis of radiosonde data taken in the different source areas 24 hours ahead. The source areas arriving at different heights are situated at different geographical positions and pressure levels. Strong vertical mixing can limit the applicability of the method. Comparisons between forecast and persistency for temperature and dew point depression are given and indicate forecast improvement in 20 to 30% of the test cases. The forecasting of amount and type of clouds is also shown to be improved. Author (ESA)

**N82-14755#** Pennsylvania State Univ., University Park. Dept. of Meteorology.
**IMPACT OF DATA AND INITIALIZATION PROCEDURES ON VARIATIONS OF VERTICAL MOTION AND PRECIPITATION IN MESOSCALE MODELS**
Richard A. Anthes, Eirh-Yu Hsie, Daniel Keyser, and Ying-Hwa Kuo *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 245-257 refs (For primary document see N82-14716 05-47)
(Contract N00014-78-C-0775; Grant NSF ATM-78-02699)
Avail: NTIS HC A19/MF A01; ESA, PARIS FF 160 Member States, AU, CN and NO (+20% others)

The sensitivity of mesoscale models to variations in initial data was investigated. A two-dimensional model of frontogenesis that contains prognostic equations for cloud and precipitation water is used to help establish the resolution in the moisture, temperature, divergence and vorticity fields that is necessary to predict precipitation on the mesoscale. In these simulations, the precipitation forecast over a 15 hr period does not depend strongly on mesoscale detail in the initial conditions of these variables. In 12 hr forecasts using real data, the frequency and amplitude of inertia-gravity waves is insensitive to the initial divergence and temperature fields. The 12 hr forecasts of precipitation are also insensitive to the variations in initial divergence tested. Author (ESA)

**N82-14756*#** Air Force Global Weather Central, Offutt AFB, Nebraska.
**THE INITIALIZATION OF A MESOSCALE WEATHER PREDICTION MODEL USING SATELLITE AND PRECIPITATION DATA**
Terry C. Tarbell, Thomas T. Warner (Pennsylvania State Univ., University Park), and Stephen W. Wolcott (US Geological Survey, Albany, New York) *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 259-264 refs Sponsored in cooperation with NSF (For primary document see N82-14716 05-47)
(Grants NsG-5205; EPA-R-805669-01)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 04B

An analysis and initialization procedure was developed capable of utilizing mesoscale satellite and radar data to resolve features in moisture and momentum fields on a finer scale than is discernible from radiosonde observation networks. The radiosonde moisture field is enhanced, using infrared satellite imagery and precipitation data from the surface observation network (also obtainable from the radar network) while the observed mesoscale rainfall rates are also used to define the initial divergent wind component. Results show that the predicted rainfall amounts are significantly improved when these additional data are taken into account. Author (ESA)

**N82-14757#** Wisconsin Univ., Madison. Dept. of Meteorology.
**UTILIZING SATELLITE WIND DATA IN A MESOSCALE NUMERICAL MODEL**
Dong Kyou Lee and David D. Houghton *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 265-270 refs (For primary document see N82-14716 05-47)
(Grants NSF ATM-77-20231; NSF ATM-80-05369)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

High resolution satellite and surface wind data were incorporated into a mesoscale numerical prediction model of the south central United States. Mesoscale data sets approach the level of comprehensiveness for mesoscale phenomena and for their simulation by numerical techniques. Correspondence of the satellite data to rawinsonde observations is analyzed. Differences between forecasts with and without the special initial wind data identify the impact of this data. Oscillations indicative of adjustement processes with time scales of 0.5 and 3 hr are evident in the insertion cases. The primary impact of the inserted data is to alter the amplitude of mesoscale features that develop in the control forecast. Author (ESA)

**N82-14758#** Australian Numerical Meteorology Research Center, Melbourne.
**THE NUMERICAL SIMULATION OF INTENSE FRONTAL DISCONTINUITIES OVER SOUTHEASTERN AUSTRALIA**
D. J. Gautlett *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 271-275 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The development and movement of an intense frontal discontinuity up the New South Wales coast of Australia using a nested, moveable fine mesh (MFM) model was studied. This model is based on full primitive equations and incorporates orographic effects, convection and relevant boundary layer fluxes. The resolution of the interior moving grid was set at 60 km. It is demonstrated that the the capacity of the MFM model simulates the essential features of the front and identifies it as a coastally trapped gravity current. Author (ESA)

**N82-14759#** Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
**SHORT-RANGE WEATHER FORECASTS AND CURRENT WEATHER INFORMATION: USER REQUIREMENTS AND ECONOMIC VALUES**
Allan H. Murphy and Barbara G. Brown *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 279-290 refs (For primary document see N82-14716 05-47)
(Grant NSF ATM-80-04680)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

User requirements and economic values of short range forecasts and current weather information are reviewed. Methods

of determining requirements and estimating values are described. The results of selected user requirement and economic value studies related to short range weather forecasts are reviewed. Topics are examined decision analytically. Market investigations are recommended to precisely define requirements and allocate resources. Author (ESA)

**N82-14760#** Wessex Water Authority, Bristol (England).
**REQUIREMENTS OF A WATER AUTHORITY FOR SHORT PERIOD LOCAL FORECASTS**
M. R. Senior *In* ESA Nowcasting: Mesoscale Observations and Range-Short Prediction Jun. 1981 p 291-294 (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The principal functions of a water authority are introduced and data used in heavy rainfall predictions for flood warning purposes, in the operation of regulating reservoirs, penned drainage channels and sewage treatment works are discussed. Requirements for predictions such as wind and temperature, for preparation for tidal flooding and inland flooding due to snowmelt, are outlined. Author (ESA)

**N82-14761#** Royal Netherlands Meteorological Inst., De Bilt.
**A BEACH COMFORT INDEX USED BY THE NATIONAL WEATHER SERVICE IN THE NETHERLANDS**
J. F. denTonkelaar *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 295-298 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The relation between the weather and the feeling of physical comfort of visitors of seaside resorts was investigated. A beach comfort index was established for forecast communication to the general public. The beach comfort index is determined on a scale from 1 to 10, relating the opinions obtained in interviews to specific combinations of effective degree of cloudiness, wind speed, and air temperature. Data recorded in diagram form. Forecasts are issued during the summer and for easy communication to the public, are phrased in descriptive terms (poor, rather poor, moderate, rather good, good, and very good).Author (ESA)

**N82-14762#** Gulf Coast Weather Service, Tampa, Fla. WTVT Weather Service.
**WEATHERVISION: A FORECASTING AND DISSEMINATION TOOL FOR THE 1980'S**
Roy Leep *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 299-302 ref (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The Weathervision system a medium sized computer for meteorological broadcasting which is capable of generating color television graphics in near real time is discussed. The system stores a great deal of weather data, and is designed for presenting real time analyses for nowcasting from satellite, radar and facsimile data. Each of the pertinent subsystems are described as well as the remote color graphic terminals at distant locations for additional forecast offices. It is found that the weathervision system is flexible and reliable. Author (ESA)

**N82-14763#** Air Force Geophysics Lab., Hanscom AFB, Mass. Mesoscale Forecasting Branch.
**THE MODULAR AUTOMATED WEATHER SYSTEM (MAWS) CONCEPT**
Donald A. Chisholm, Richard H. Lynch, and James C. Weyman *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 303-307 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A modular automated weather system (MAWS) which is a supervisory microprocessor that manages, disseminates and archives visibility, wind, temperature, and dew point measurements as well as outputs from ceilometers, transmissometers, digital alimeters, and digital clocks is discussed. Results are assessed for: (1) aviation weather elements and sensors suitable for automation; (2) sensor siting requirements for aviation critical weather elements; (3) performance potential of microprocessor components, display devices and communication systems; (4) the importance of met watch parameters in support of aviation operations; and (5) utility of short range forecast guidance based on simple statistical models. A microprocessor based MAWS system satisfies most automated observation requirements and provides an essential data base for the development of operational prototypes. Author (ESA)

**N82-14764#** Swedish Military Weather Service, Stockholm.
**WEATHER 80**
Fritz Larsson and Gustav Grandin *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 309-310 (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A meteorological data transfer system which provides forecasters at an airbase with tailored information from regional centers, is described. The regional centers transmit weather maps, thermodynamic diagrams at 4800 bits/sec to the bases, with alphanumerical and graphical displays. The system is faster and more accurate than manual handling of teleprinter lists or reception of radio facsimile maps. Author (ESA)

**N82-14765#** European Cooperation in the Field of Scientific and Technical Research, Helsinki (Finland).
**COST 72: EUROPEAN WEATHER RADAR PROJECT**
G. A. Clift *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 313-316 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The European weather radar project (COST 72), aimed at establishing an integrated European weather radar network suitable for operational purposes is assessed. Benefits expected include better short term forecasting of precipitation intensities, better timing of forecasts, flood warnings, and water resource management. User requirements of a great many organizations are considered in relation to data exchange, radar/rain gage comparisons, production of software specifications, establishment of a trial network, and merging of radar data with those from other meteorological sources. Author (ESA)

**N82-14766#** Swiss Inst. of Meteorology, Locarno-Monti. Osservatorio Ticinese.
**THE SWISS NETWORK OF 2 DIGITAL RADARS AND 60 AUTOMATIC WEATHER STATIONS**
H. P. Roesli *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 317-322 (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Two networks for mesoscale observation are presented: (1) the ANETZ system, involving some 60 automatic weather stations, and (2) a radar network of two digital weather radars. The radars are under the control of a minicomputer which generates ground plan and side views of the maximum reflectivities. The limits of operational quantitative measurements are discussed. In ANETZ, a minicomputer collects, processes and distributes the observations. Examples of access to real time data are given and their use in nowcasting is illustrated. It is shown that the networks stimulate the development of different methods in nowcasting and in display of meteorological data. Author (ESA)

**N82-14767#** Royal Signals and Radar Establishment, Malvern (England). Meteorological Office Radar Research Lab.
**A SYSTEM FOR THE COMBINED USE OF DATA FROM MULTIPLE RADARS AND SATELLITES IN THE UNITED KINGDOM**
C. G. Collier *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 323-330 refs Original contains color illustrations (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A weather forecasting pilot project, consisting of a network of four weather radars along with digital facilities for receiving

satellite and conventional meteorological data is discussed. Data processing is carried out in real time within a minicomputer network, mostly over communication lines. Instantaneous fields of precipitation as well as rainfall totals integrated for short periods over areas defined by users are distributed from each radar site. At the network center, a precipitation picture and forecasts of precipitation 6 hr ahead covering a wide area are prepared. The further development of the central facilities, leading to a prototype operational interactive computer system, forecasting rain optimised using new techniques of interactive enhanced radar and satellite system (FRONTIERS) is also discussed.

Author (ESA)

**N82-14768#** Swedish Meteorological and Hydrological Inst., Norkoeping.

**AUTOMATED TECHNIQUES FOR SATELLITE IMAGERY ANALYSIS**

Erik Liljas *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 331-339 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The role of geostationary and polar orbiting weather satellites in an observational network for nowcasting is discussed. The operational satellite systems and work on the use of satellite information is reviewed. An operational technique for automatic multispectral analysis for advanced very high resolution data from Tiros N satellites which yields cloud type and precipitation intensity displayed on color television is presented. It is indicated that functioning over sea areas, in frontal precipitation and in mesoscale cloud clusters take place. Author (ESA)

**N82-14769#** Japan Meteorological Agency, Tokyo.

**THE MESOSCALE OBSERVATIONAL NETWORK IN JAPAN**

Ryozo Tatehira, Michio Hitsuma, and Yoshihisa Makino *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 341-346 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Systems to analyze and forecast mesoscale weather phenomena in Japan are presented. The systems comprise: (1) a weather radar network, involving 20 sites, capable of 2 km resolution and equipped with standardized digitizers, giving composite echo patterns with a 5 km mesh; (2) an automated meteorological data acquisition system, grouping 1300 stations for precipitation monitoring and some 800 stations for surface wind, temperature and sunshine measurements; and (3) the geostationary meteorological satellite, (GMS), providing cloud images, with a resolution of 2 km in the visible channel and 7 km in the infrared channel. Because of a 40 min time lag in the reception of the GMS pictures, system (3) is not suited for nowcasting. Author (ESA)

**N82-14770#** National Oceanic and Atmospheric Administration, Boulder, Colo. PROFS Program Office.

**DESIGN OF A SHORT RANGE FORECASTING SYSTEM**

Donald W. Beran and Alexander E. MacDonald *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 347-350 (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The complexity of designing a total short range forecasting system is discussed. A design methodology (PROFS program) which produces optimum specifications for operational forecast systems is proposed. In the PROFS design, data sets are drawn from all conventional synoptic scale information, a dense surface network, conventional and Doppler radar, high resolution satellite data, and continuous upper air profiles. The worth of each data set is examined in combination with others; optimum combination and communication techniques form the basis for functional design specifications. Author (ESA)

**N82-14771#** Swedish Meteorological and Hydrological Inst., Norkoeping.

**PROMIS-90: FUTURE SWEDISH WEATHER SERVICE SYSTEM**

Svante Bodin *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 351-355 (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A weather service system, providing both nowcasting and long range forecasting capabilities is presented. The noncasting function are performed by a regionalized system based on modern weather radar, satellite data, automatic stations, and real time data collection systems. Long range forecasting is carried out by computer models and statistical techniques, largely automated. User requirement analysis, system descriptions, and staff estimates are included. Author (ESA)

**N82-14772#** Logica Ltd., Cobham (England).

**THE DESIGN OF THE FRONTIERS INTERACTIVE DISPLAY SYSTEM**

N. J. Saker *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 357-361 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The design plans of the FRONTIERS system, which combines radar, satellite, and synoptic weather data in an interactive graphic display to produce real time analyses and forecasts of rainfall are outlined. Rapid interaction with the display computer to perform quality control of input data or to modify objective forecasts is emphasized. The data processing of radar and satellite data and the overall system design, comprising display computer, graphic display unit, interface with the forecaster and software facilities are discussed. The development of the software is described. Author (ESA)

**N82-14773#** Air Force Geophysics Lab., Hanscom AFB, Mass. Mesoscale Forecasting Branch.

**AN ASSESSMENT OF MESOSCALE FORECAST EXPERIMENTS**

H. S. Muench and D. A. Chisholm *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 363-367 refs (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A mesoscale network which provides short range forecasting at airfield terminals, and a number of objective techniques developed in that process are described. The visibility forecast problem was treated. Objective techniques for forecasting radiation fog, advection fog and convective showers were developed and skill scores, relative to Markov, for each technique are presented. It is indicated that, although improvement over persistence can be obtained, the behavior of low visibility patterns is quite complex and can only partially be forecasted by simple extrapolation. Deployment of interactive computer graphics increases the analysis capabilities and improvements in nowcasting are expected. Author (ESA)

**N82-14774#** Swedish Military Weather Service, Stockholm.

**AN OPERATIONAL METHOD FOR FORECASTING STRATUS AND FOG**

Gustav Grandin *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 369-372 (For primary document see N82-14716 05-47)

Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A short range forecast model of increase and dissolution of the cloud base of stratus, or fog, is described. Solar short wave radiation is estimated from latitude, season, and time of day. Radiation absorbed at the surface, and long wave radiation from higher clouds and moist air above the stratus are calculated. The balance between cooling, due to long wave radiation, and surface heating, caused by short wave solar radiation, determines the cloud base development. It is assumed that the cloud top has a constant height, or to increase due to an empirical function, and when the cloud base reaches cloud top it is dissolved. A mean deviation of + 11 m for a forecast time of 2 hrs, where no horizontal advections are considered is shown. It is concluded that surface albedo has little effect, but long wave radiation is crucial in cloud base development. Author (ESA)

**N82-14775*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**MESOSCALE ASPECTS OF JET STREAK COUPLING AND IMPLICATIONS FOR THE SHORT TERM FORECASTING OF SEVERE CONVECTIVE STORMS**
Louis W. Uccellini and Paul J. Kocin *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 375-380 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others) CSCL 04B

An analysis of a tornado outbreak in Wichita Falls, Texas was analyzed. The coupling of upper and lower tropospheric jet streaks, leading to severe storm outbreaks is illustrated. The high resolution SESAME data sets indicate that mass and momentum adjustments which couple upper and lower tropospheric jets occur within a 3 to 6 hr time frame over a 100 to 500 km domain, and establish the role of isallobaric forcing in the storm development. It is suggested that the output rate of data from the existing 12 hr network be increased to provide better temporal resolution of wind, mass and moisture data.
Author (ESA)

**N82-14776#** National Center for Atmospheric Research, Boulder, Colo.
**LIFE CYCLE OF MESOSCALE CONVECTIVE SYSTEMS**
Edward J. Zipser *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 381-386 refs Sponsored by NSF (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

Structural features of tropical convective systems are reviewed, and the interaction between convective clouds and associated mesoscale stratiform cloud systems which evolve with time are emphasized. A typical life cycle is illustrated, and differences between tropical and mid latitude systems are discussed. Awareness of the typical evolution of such systems can improve interpretation of a real time mesoscale data stream. Possible uses of a life cycle model in very short range forecasting are discussed.
Author (ESA)

**N82-14777#** Hydrometeorological Centre of the USSR (Moscow).
**MESOSCALE STRUCTURE OF ATMOSPHERIC FRONTS IN THE EUROPEAN PART OF THE U.S.S.R.**
A. A. Lyakov and Nathalie P. Shakina *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 387-392 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The structure of a slowly moving cold front and of two occluded and regenerating cyclones were analyzed, using rawinsonde data, spectral analysis and air flow stability theory. Hyperbaroclinic zones in the middle troposphere and air flow of the conveyor belt type are shown. The possible effects of symmetric instability on the periodic structure formation are also discussed.
Author (ESA)

**N82-14778#** Colorado State Univ., Fort Collins. Applications Lab.
**COMBINING SATELLITE AND CONVENTIONAL DATA FOR VERY SHORT RANGE FORECASTING PURPOSES**
James F. W. Purdom *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 393-400 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The importance of satellite data for nowcasting is illustrated and convection is emphasized. The clouds and cloud patterns observed in satellite images represent the integrated effect of ongoing dynamic and thermodynamic processes. The GOES system is described. Data, mesoscale applications, using GOES imagery in the areas of morning stratus and fog, and convective storms are considered. The unique capability of satellite imagery in the detection of precursor or trigger mechanisms for strong convection is emphasized.
Author (ESA)

**N82-14779#** National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
**GEM: A SIMPLE METEOROLOGICAL BUOY WITH SATELLITE TELEMETRY**
R. Michael Reynolds *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 401-404 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A small, easily deployable and inexpensive buoy was developed for mesoscale research. The synthesis of the detailed parameter fields necessary for mesometeorology necessitates the deployment of a network of buoys that are less expensive than most standard designs. Vector averaged winds, scaler winds, air temperature, water temperature, and gusts are measured. Compass readings provide surface current direction. The buoy transmits data via the GOES satellite which eliminates the need for internal tape recording. Computer processing of the data is described. Proper counterbalancing and vector averaging are shown to reduce the effects of buoy motion.
Author (ESA)

**N82-14780#** Institute for Storm Research, Inc., Houston, Tex.
**A LAYERED MESOSCALE PREDICTION MODEL INITIALIZED AND VERIFIED BY SATELLITE DATA**
John C. Freeman and Jill F. Hasling *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 405-410 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

A mesoscale meteorological model that takes into account horizontally propagating gravity waves, vertical wind shear, moisture, variations in orography, rotation of the Earth, and friction was developed. It can be used with satellite data on clouds and precipitation. It is shown that if an area is covered with clouds for a sufficient time, there is sufficient data on cloud motion and heights to allow the development and continued computation of the full motion and cloud field over the whole area. Examples are shown on the evolution of thunderstorms behind a cold front.
Author (ESA)

**N82-14781#** Finnish Meteorological Inst., Helsinki.
**OPERATIVE WARNINGS; ROUTINE SERVICES AND ONGOING EXPERIMENTAL WORK IN FINLAND**
Marianne Saagbom *In* ESA Nowcasting: Mesoscale Observations and Short-Range Prediction Jun. 1981 p 413-415 refs (For primary document see N82-14716 05-47)
Avail: NTIS HC A19/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

The requirements of potential users of short range weather forecasts and measures to be taken to fulfill those needs in Finland are reviewed. In addition to routine short range weather predictions, specific warning on operational effects of small scale meteorological phenomena, such as wind shear or slipperiness, is required for aviation. The importance of a specialized weather service for road maintenance was borne out on slipperiness, fog and crosswind, both economically and operationally.
Author (ESA)

**N82-14782#** Weather Wing (5th), Langley AFB, Va.
**TERMINAL FORECAST REFERENCE NOTEBOOK, DETACHMENT 9, 12TH WEATHER SQUADRON (MAC), TYNDALL AFB, FLORIDA Final Report**
1 Feb. 1981 120 p
(AD-A105085; AD-E850102; Rept-5WW-TFRN-81/003) Avail: NTIS HC A06/MF A01 CSCL 04/2

This terminal forecast reference notebook is for Tyndall AFB, Florida. It describes the following topics concerning forecasting weather at Tyndall AFB: location, topography, and local effects; impact of weather on supported units; synoptic climatology; climatic aids; operationally significant forecast problems; approved forecast studies; rules-of-thumb; and special synoptic studies and reference.
GRA

**N82-14783#** Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
**MECHANISM OF ICE CRYSTAL GROWTH HABIT AND SHAPE INSTABILITY DEVELOPMENT BELOW WATER SATURATION M.S. Thesis - Univ. of Utah**
Gerald Douglass Swoboda Aug. 1981 139 p refs
(Grant NSF ATM-80-04108)
(AD-A105520; AFIT-CI-81-32T) Avail: NTIS

HC A07/MF A01 CSCL 08/12

Ice phase process in supercooled clouds play dominant roles in development of updrafts and downdrafts as well as various forms of precipitation. In a supercooled cloud, an ice phase process begins normally with vapor diffusional growth of ice crystals. Consequently, the vapor diffusional growth of ice crystals is of importance in cloud physics. Starting from the concept of the wedge-shaped ice thermal diffusion chamber of Schaller and Fukuta, where ice crystals can be grown under a range of ice supersaturations at a constant temperature in quiescent, temperature-stratified air, and by considering design and operational limitations, a new wedge-shaped ice thermal diffusion chamber was designed and constructed for this study of ice crystal growth habit and shape instability. This chamber and supporting apparatus define an experimental system capable of adequately controlling the temperature and supersaturation fields around the growing crystal. In addition to the wedge-shaped chamber, apparatus defining this experimental system are the pre-chamber, ice crystal slide mechanism, lateral microscope slide mechanism, sample transfer device, and outer environmental chamber. GRA

**N82-14784#** Institut Royal Meteorologique de Belgique, Brussels.
**A STATISTICAL MODEL OF WIND DISTRIBUTION IN FORCE AND IN DIRECTION: APPLICATION TO UCCLE (BRUSSELS) DATA AND VALIDITY OF THE MODEL FOR BELGIUM [UN MODELE STATISTIQUE DE LA REPARTITION DES VENTS EN FORCE ET EN DIRECTION: APPLICATION AUX DONNEES D'UCCLE (BRUXELLES) ET VALIDITE DU MODELE POUR LA BELGIQUE]**
R. Sneyers 1980 21 p refs In FRENCH; ENGLISH summary Presented at 16th Congr. de Meteorol. Alpine, Aix-les-Bains, France, Sep. 1980
(PUBL-SER-B-107) Avail: NTIS HC A02/MF A01

The adjustment of a statistical model of wind so that the entire set of empirical data obtained for each of the 12 months of the year can be taken into account was studied. The resultant model can be used to determine, for whatever time of year and for whatever wind direction, the probability of the associated wind of given velocity. The distribution at Uccle of the wind speeds is represented through gamma distributions, the shape parameter of which can be considered independent of both wind direction and time of year. The mean speed thus fully characterizes each distribution. The mean speed is shown as a periodic function of the time of year as well as of the wind direction. Author (ESA)

**N82-14785#** Institut Royal Meteorologique de Belgique, Brussels.
**ON THE METEOROLOGICAL MEANING OF THE TERMS GUST, STORM, AND HURRICANE [SUR LE SENS METEOROLOGIQUE DES TERMES COUP DE VENT, TEMPETE ET OURAGAN]**
L. Dufour 1981 27 p refs In FRENCH
(PUBL-SER-B-109) Avail: NTIS HC A03/MF A01

Meteorological terms, associated with the Beaufort anemometrical scale, are considered. Meteorological connotations and lexicological references are cited. The terms are defined as to wind velocity calculated over 10 min intervals, i.e. gust: 34 to 40 knots; storm: 48 to 55 knots; hurricane: > 64 knots. Author (ESA)

**N82-14786#** National Oceanic and Atmospheric Administration, Kansas City, Mo.
**THE ENHANCED V, A SATELLITE OBSERVABLE SEVERE STORM SIGNATURE**
Donald W. McCann Mar. 1981 38 p refs
(PB81-230328; NOAA-TM-NWS-NSSFC-4; NOAA-81052202) Avail: NTIS HC A03/MF A01 CSCL 04B

Enhanced infrared satellite imagery was used to examine severe thunderstorms that display a warm spot accompanied by a signature called an enhanced V, formed when strong upper level winds are diverted around an overshooting thunderstorm top. When a storm has an enhanced V, it has a high probability of subsequently producing severe weather. Two rules for identification of an enhanced V are established. The median lead time from enhanced V identification to the first severe weather report was 30 minutes. A low false alarm ratio makes this identification technique a potential severe storm warning tool. GRA

**N82-14787#** National Oceanic and Atmospheric Administration, Washington, D. C. National Earth Satellite Service.
**THE EFFECT OF PRECIPITATION ON MICROWAVE SOUNDINGS IN LOW LATITUDES**
Lester F. Hubert, Norman C. Grody, Andrew Timchalk, and William C. Shen Apr. 1981 43 p refs
(PB81-225062; NOAA-TR-NESS-82; NOAA-81051405) Avail: NTIS HC A03/MF A01 CSCL 04B

The use of the Scanning Microwave Spectrometer (SCAMS) data to derive atmospheric temperature profiles in tropical latitudes was studied. A cold low which passed to the south of Hawaii, Feb. 1976, is investigated. SCAMS clear atmosphere and cloud cluster retrievals with nearby rawinsonde temperatures are compared. It is suggested that either the area of active cloud convection contains vigorous updrafts over much more than 5% of the cloud area or that liquid water densities in the upper part of the clouds are much greater than 2.0 g/cu m. It is indicated that precipitation induced errors in the microwave retrievals are greatest and most frequent in convective cloud areas. GRA

**N82-14788** Iowa Univ., Oakdale.
**VARIABILITY OF SEASONAL PRECIPITATION OVER THE CONTERMINOUS UNITED STATES, 1948-1976 Ph.D. Thesis**
Marie Rose Popp Klugman 1981 192 p
Avail: Univ. Microfilms Order No. 8123329

The variability of seasonal precipitation for 104 climatological stations in the conterminous United States was investigated. A statistically sound procedure for testing the significance of precipitation variations which was outlined and circulation anomalies which are related to precipitation extremes or use in seasonal forecasting were identified. A variance components model was used to test the significance of the precipitation variability for each of the four seasons at each station. A chain-dependent model which incorporates Markov chains was used to model the daily data. The Schwarz Bayesian Criterion was employed to determine the order of Markov chain dependence in the daily data. The source of anomalous component of the airflow into areas with significant precipitation variability was traced to land areas and cold oceans in low precipitation years and to warm water bodies in high precipitation years. These relationships can be used as the basis for predicting anomalous seasonal preciptation amounts. Dissert. Abstr.

# 48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

**N82-14789*#** Illinois Univ., Urbana. Radio Research Lab.
**REMOTE SENSING OF SEA STATE BY LASER ALTIMETERS**
B. Tsai and C. S. Gardner Dec. 1981 51 p refs
(Grant NsG-5049)
(NASA-CR-165049; RRL-Publ-514) Avail: NTIS HC A04/MF A01 CSCL 08C

The reflection of short laser pulses from the ocean surface was analyzed based on the specular point theory of scattering. The expressions for the averaged received signal, shot noise and speckle induced noise were derived for a direct detection system. It is found that the reflected laser pulses have an average shape closely related to the probability density function associated with the surface profile. This result is applied to estimate the mean sea level and significant wave height from the receiver output of the laser altimeter. T.M.

**N82-14790*#** National Aeronautics and Space Administration, Washington, D. C.
**LIGHT FIELDS IN THE OCEAN**
V. N. Pelevin and M. V. Kozlyaninov Nov. 1981 267 p refs Transl. into ENGLISH from the book "Svetovyye Polya v Okeane" Moscow, 1979 p 1-232, 243-258 Transl. by Scientific Translation

Service, Santa Barbara, Calif. Original doc. prep. by Academy of Sciences (USSR)
(Contract NASw-3542)
(NASA-TM-76731) Avail: NTIS HC A12/MF A01 CSCL 08C

The problem of light fields in the ocean is in basic ocean optics. Twenty-six separate studies discuss: (1) the field of solar radiation in the ocean; (2) stationary and nonstationary light fields created in the sea by artificial sources; and (3) the use of optical methods to study biological and hydrodynamic characteristics of the sea. A.R.H.

**N82-14791#** Naval Surface Weapons Center, Dahlgren, Va.
**GLOBAL OCEAN TIDES. PART 4: THE SEMIDIURNAL ELLIPTICAL LUNAR TIDE (N2), ATLAS OF TIDAL CHARTS AND MAPS Final Report**
E. W. Schwiderski May 1981 88 p refs
(ZR0000101)
(AD-A105949; NSWC/TR-81-218-Pt-4) Avail: NTIS HC A05/MF A01 CSCL 08/3

In Part I (Schwiderski, 1978a) of this report, a unique hydrodynamical interpolation technique was introduced, extensively tested, and evaluated in order to compute partial global ocean tides in great detail and with a high degree of accuracy. This novel method has been applied to construct the semidiurnal elliptical lunar (N2) ocean tide with a relative accuracy of better than 5 cm anywhere in the open oceans. The resulting tidal amplitudes and phases are tabulated on a 1 deg x 1 deg grid system in an atlas of 42 deg x 71 deg overlapping charts covering the whole oceanic globe. A corresponding atlas of global corange and cotidal maps is included to provide the reader with a quick general overview of the major tidal phenomena. The specifying hydrodynamical parameters of the model are listed along with quoted sources of empirical tide data, and significant tidal features are explained and discussed. The semidiurnal N2 ocean tide is found to resemble closely the semidiurnal M2 and S2 tides (compare Parts II and III). As mentioned in Parts II, III, IV, and V only qualitative similarities are displayed between the semidiurnal and diurnal ocean tides. Author (GRA)

**N82-14792#** Naval Surface Weapons Center, Dahlgren, Va.
**THE NSWC GLOBAL OCEAN TIDE DATA TAPE (GOTD). ITS FEATURES AND APPLICATION: RANDOM-POINT TIDE PROGRAM**
E. W. Schwiderski and L. T. Szeto Jun. 1981 41 p
(ZR0000101)
(AD-A105974; NSWC/TR-81-254) Avail: NTIS HC A03/MF A01 CSCL 08/3

In the following report, the authors highlight briefly the major qualitative and quantitative features of the NSWC ocean tide models, which now include the nine components (M2, S2, N2, K2), (K1, O1, P1, Q1), and Mf with models for Mn and Ssa nearing completion. Special characteristics of those models are pointed out, which require indispensable attention in various applications particularly in coastal areas with rapidly varying tides. Since the tide models interpolate hydrodynamically empirical tide data at over 2000 continental and island stations, certain simple corrections in the numerical procedures are presented. Plans for more extensive local and perhaps global refinements and improvements of the tide models are mentioned. In the final part of this report, the authors describe the NSWC Global Ocean Tide Data (GOTD) tape including the data arrangement and the standard format. The report ends with a program that computes from the taped harmonic tidal constants instantaneous oceanic and geocentric tides at specified random points and instances in the Random-Point Tide (RPTIDE) program. Author (GRA)

# 51 LIFE SCIENCES (GENERAL)

Includes genetics.

**N82-14793** Emory Univ., Atlanta, Ga.
**STUDIES IN IN VIVO ELECTROCHEMISTRY Ph.D. Thesis**
Wayne Stuart Lindsay 1981 303 p
Avail: Univ. Microfilms Order No. 8124252

The design and construction of instrumentation for in vivo electrochemistry, solution and in vivo characterization of microworking electrodes, the use of the multielectrode system for pharmacological and behavioral studies, statistical analysis of data, simulation studies, and the first chronoamperometric recording from a rhesus monkey are presented. In vivo data using different values for some of the experimental parameters in the simulation equation were compared to simulated data. Chronoamperometric recordings were made from the brain of an unanesthetized rhesus monkey. The electrochemical signal increased during emotional excitation and feeding. Dissert. Abstr.

**N82-14794*#** National Aeronautics and Space Administration, Washington, D. C.
**POLYPLOIDIZATION DELAY IN RAT HEPATOCYTES UNDER LIVER GROWTH INHIBITION BY HYPOKINESIA**
V. M. Faktor, V. F. Malyutin, S. Y. Li, and V. Ya. Brodskiy Jul. 1981 10 p refs Transl. into ENGLISH from Tsitologiya (USSR), v. 21, no. 4, 1979 p 397-400
(Contract NASw-3199)
(NASA-TM-76515) Avail: NTIS HC A02/MF A01 CSCL 06C

A study of young rats, weighing 55 to 59 g, after being for 10 days in conditions of limited mobility, shows a retardation of body growth as well as that of liver growth. The decrease in the rate of growth is accompanied by a reduction of cell proliferation and by delay polyploidization of hepatocytes in the liver of experimental rats. The materials, methods, and results of research are discussed. M.D.K.

**N82-14795#** Jackson Lab., Bar Harbor, Maine.
**INBORN ANEMIAS IN MICE Progress Report, 1 Aug. 1980 - 1 Jun. 1981**
Seldon E. Bernstein, Jane E. Barker, and Elizabeth S. Russell Jun. 1981 36 p
(Contract DE-AC02-76EV-03264)
(DE81-029128; DOE/EV-03264/20) Avail: NTIS HC A03/MF A01

Four macrocytic anemias, five hemolytic anemias, nonhemolytic microcytic anemia, transitory siderocytic anemia, sex-linked iron-transport anemia, an alpha-thalassemia, and a new target-cell anemia were studied. Each of these blood dyscrasias is caused by the action of a unique mutant gene, which determines the structure of different intracellular molecules, and thus controls a different metabolic process. The potential for uncovering different aspects of hemopoietic homeostatic mechanisms in the mouse is considered. Each anemia is studied through: (1) characterization of peripheral blood values, (2) determinations of radiosensitivity under a variety of conditions, (3) measurements of iron metabolism and heme synthesis, (4) histological and biochemical study of bloodforming tissue, (5) functional tests of the stem cell component, (6) examination of responses to erythroid stimuli, and (7) transplantation of tissue between individuals of differently affected genotypes. DOE

# 52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

**N82-14796#** Southwest Research Inst., San Antonio, Tex.
**PLAN OF ACTION AND MILESTONES FOR NAVY COMBUSTION TOXICITY Final Report**
R. E. Adler, H. Kaplan, and M. D. Pish 1 Jan. 1981 33 p
(Contract N00173-80-C-0125)
(AD-A105623) Avail: NTIS HC A03/MF A01 CSCL 13/10

This report reviews the Workshop on Toxicology of Combustion Products held at the Naval Research Laboratory on 15-16 October 1980. Participants included U.S. Navy, other government activities, and U.S. Industry. The use of plastic materials has become more prevalent in the design of equipment and in shipboard construction. Use of these materials in quantity can create severe generation of toxic gases which can incapacitate or kill personnel in shipboard fires even if they are not in the immediate fire area. Author (GRA)

**N82-14797#** Mitre Corp., McLean, Va.
**EVALUATION OF SHORT-TERM BIOASSAYS TO PREDICT FUNCTIONAL IMPAIRMENT. SELECTED SHORT-TERM PULMONARY TOXICITY TESTS Final Report, Sep. 1978 - Jul. 1980**
Steve Drill and Richard Thomas Oct. 1980 131 p refs
(Contract DAMD17-78-C-8068)
(AD-A103766; MTR-80W00233) Avail: NTIS HC A07/MF A01 CSCL 06/20

Short term bioassays which demonstrate ability to assess and predict impairment of the pulmonary system resulting from exposure to chemicals were evaluated. Test procedured for determining toxic effects on the lungs and other components of the plumonary system are reviewed. The procedures are discussed in sections on morphology, respiratory mechanics, gas exchange, circulation, defense mechanisms and biochemistry. Author

**N82-14798#** Mitre Corp., McLean, Va.
**EVALUATION OF SHORT-TERM BIOASSAYS TO PREDICT FUNCTIONAL IMPAIRMENT. DEVELOPMENT OF PULMONARY BIOASSAYS IN SMALL ANIMALS: DIRECTORY OF INSTITUTIONS; INDIVIDUALS INVOLVED IN UTILIZATION Final Report**
Steve Drill, Richard Thomas, and Terry Zimmerman Oct. 1980 133 p
(Contract DAMD17-78-C-8068)
(AD-A103767; WP-79W00222) Avail: NTIS HC A07/MF A01 CSCL 06/20

Short term bioassays which demonstrated ability to evaluate and predict pulmonary impairment resulting from toxicant exposures were evaluated. This directory describes available pulmonary testing protocols and assesses their suitability for a screening program. Organizations currently engaged in pulmonary bioassay utilization or development are catalogued and information concerning specific measurements performed, test systems employed, compounds tested, requirements for anesthesia and terminal nature of the test are provided. Author

**N82-14799#** Oak Ridge National Lab., Tenn. Industrial Safety and Applied Health Physics Div.
**INTDOS: A COMPUTER CODE FOR ESTIMATING INTERNAL RADIATION DOSE USING RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION**
M. T. Ryan Sep. 1981 25 p refs
(Contract W-7405-eng-26)
(DE82-000507; ORNL/TM-7928) Avail: NTIS HC A02/MF A01

A user oriented computer code, INTDOS, to calculate estimates of internal radiation dose commitment resulting from the acute inhalation intake of various radionuclides was designed. The user must identify the radionuclide name, solubility class, particle size, time since exposure, and the measured lung burden. The INTDOS calculates the fraction of the lung burden remaining at time, t, postexposure considering the solubility class and particle size information. Effective committed dose equivalents to various organs and tissues of the body are calculated using inhalation committed dose factors. DOE

**N82-14800#** Brookhaven National Lab., Upton, N. Y. Biology Dept.
**REPAIR OF RADIATION DAMAGE IN MAMMALIAN CELLS**
R. B. Setlow 1981 16 p refs Presented at the NATO CNEN Conf., Rome, 24 Aug. 1981.
(Contract DE-AC02-76CH-00016)
(DE81-030824; BNL-30056; B10-3766; CONF-810873-2) Avail: NTIS HC A02/MF A01

The responses as survival, mutation, and carcinogenesis, of mammalian cells and tissues to radiation which are dependent not only on the magnitude of the damage to macromolecular structures (DNA, RNA, protein, and membranes) but on the rates of macromolecular syntheses of cells relative to the half lives of the damages are discussed. Cells possess a number of mechanisms for repairing damage to DNA. The effects of radiation and the repair of radiation damage can be explained by epidemiological data which allows the construction of dose response curves for humans. The shapes of such curves or the magnitude of the response depends on repair. Radiation damage is emphasized because: (1) radiation dosimetry is excellent compared to chemical dosimetry; (2) a number of cancer prone diseases show defects in DNA repair and radiation results in more chromosomal damage in cells from such individuals than in cells from normal individuals; (3) specific radiation products in DNA have been correlated with biological effects, and (4) many chemical effects seem to mimic radiation effects. It is indicated that damages to DNA can be the initiating events in carcinogenesis. DOE

**N82-14801#** Michigan Research Center, Inc., East Lansing.
**EVALUATIVE STUDIES IN NUCLEAR MEDICINE RESEARCH. EMISSION-COMPUTED TOMOGRAPHY ASSESSMENT Progress Report, 1 Jan. - 15 Aug. 1981**
E. James Potchen 15 Aug. 1981 18 p refs
(Contract DE-AS02-76EV-02777)
(DE81-030168; DOE/EV-02777/5) Avail: NTIS HC A02/MF A01

Imaging performance goals which need to be met to produce effective biomedical research using positron emission computer tomography are discussed. The realization of those performance goals by imaging systems, and the dependence of currently unachieved performance goals on design an operational factors along with refinement of economic estimates for the capital and operating costs of a research facility are addressed. DOE

**N82-14802#** Cornell Univ., Ithaca, N. Y. Materials Science Center.
**FIELD-ION-MICROSCOPE OBSERVATIONS OF RADIATION EFFECTS**
David N. Seidman Aug. 1981 8 p refs
(Contract DE-AS02-76ER-03158)
(DE81-030934; DOE/ER-03158/99; MSC-4555) Avail: NTIS HC A02/MF A01

The unique advantages and capabilities of the field ion microscope (FIM) and atom probe FIM for the study of the effects of particle radiation on metals are reviewed. Some contrast effects caused by radiation induced defects are discussed. DOE

**N82-14803#** Battelle Pacific Northwest Labs., Richland, Wash.
**CARCINOGENIC EFFECTS OF COAL-CONVERSION MATERIALS**
R. A. Renne and L. G. Smith Apr. 1981 29 p refs Presented at the Ind. Hyg. and Occupational Med. in Coal Conversion Proj. Workshop, Washington, D.C., 7 Nov. 1980 Submitted for publication
(Contract DE-AC06-76RL-01830)
(DE81-028108; PNL-SA-9516; CONF-801143-2) Avail: NTIS HC A03/MF A01

The correlation between mutagenesis and carcinogenesis data on complex mixtures (synfuel materials) was determined. The heavy distillate is highly mutagenic compared with the other materials tested and it was also highly carcinogenic in a mouse skin painting assay. The fractions, we give different results from those of the mutagenesis assays. The basic tar and the neutral tar skin carcinogenesis data correlate fairly well with the mutagenesis data. The need for caution against depending heavily on equating PNA content with carcinogenic activity is emphasized. It is recommended that primary aromatic amines are also monitored. DOE

## 53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**N82-14804*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**INFLUENCE OF DISPLAY AND CONTROL COMPATIBILITY ON PILOT-INDUCED OSCILLATIONS**
Marvin C. Waller, Randall L. Harris, Sr., and Lee H. Person, Jr. Dec. 1981 40 p refs
(NASA-TP-1936; L-14364) Avail: NTIS HC A03/MF A01 CSCL 05I

The differences in techniques used by seven pilots to acquire

information from an advanced display for instrument approaches to and landings on a runway were investigated. A fixed base simulator programmed with dynamics resembling the terminal configured vehicle (TCV) was studied. It is shown that the seven pilots can be divided into two groups which used the display with distinctly different strategies for controlling the airplane. A related pattern of performance differences resulted. It is found that pilots who primarily use raw flight path information experience longitudinal oscillations while pilots using attitude information did not. E.A.K.

# 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**N82-14805#** Fabrique Nationale d'Armes de Guerre, Herstal-les-Liege (Belgium).
**INITIATION INTO THE UTILIZATION OF PROGRAMMABLE INDUSTRIAL ROBOTS: GRAFCET [INITIATION A L'UTILISATION DES AUTOMATES PROGRAMMABLES INDUSTRIELS]**
P. Krzesinski Mar. 1981 25 p refs In FRENCH
Avail: NTIS HC A02/MF A01

A technique for expressing automation problems, i.e., graph of command stage and transition (GraFcet), is presented. It is intended as a methodological tool which aids in the communication of automated systems specifications between client and contractor. The language GraFcet comprehends two levels of specification. The first level describes the behavior of the command part of a system in relation to the operating part (functional specifications). The second level sets technological and environmental specifications with which the command part of a system must operate (operational specifications). Fundamental notions and the practical use of GraFcet are explained. Author (ESA)

# 55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

# 59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

**N82-14806*#** Duke Univ., Durham, N. C. Dept. of Computer Science.
**A TUTORIAL ON THE CARE III APPROACH TO RELIABILITY MODELING Interim Report**
Kishor S. Trivedi and Robert M. Geist Washington NASA Dec. 1981 63 p refs
(Grant NAG1-70)
(NASA-CR-3488) Avail: NTIS HC A04/MF A01 CSCL 14D

The CARE 3 reliability model for aircraft avionics and control systems is described by utilizing a number of examples which frequently use state-of-the-art mathematical modeling techniques as a basis for their exposition. Behavioral decomposition followed by aggregration were used in an attempt to deal with reliability models with a large number of states. A comprehensive set of models of the fault-handling processes in a typical fault-tolerant system was used. These models were semi-Markov in nature, thus removing the usual restrictions of exponential holding times within the coverage model. The aggregate model is a non-homogeneous Markov chain, thus allowing the times to failure to posses Weibull-like distributions. Because of the departures from traditional models, the solution method employed is that of Kolmogorov integral equations, which are evaluated numerically. R.J.F.

# 60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

**N82-14807#** Network Analysis Corp., Vienna, Va.
**DATA COMMUNICATIONS SUPPORT FOR THE ATC COMPUTER REPLACEMENT PROGRAM (1988-1996) Final Report**
Washington FAA Nov. 1981 200 p refs
(Contract DOT-FA79WA-4335)
(DOT/FAA/RD-81/104; FR-303H.01) Avail: NTIS HC A09/MF A01

A 'look-ahead' is provided to the data communicatons capabilities needed during the FAA's enroute computer replacement program. The support of normal ATC functions and the planned advanced enroute automation functions are considered in addition to the computer replacement requirements themselves. A mixture of packet-switched and dedicated networks utilizing both terrestrial and satellite facilities was found to be the most attractive approach to provide such support. The terrestrial packet-switched network should be highly interconnected with switches in each center and should provide virtual circuit and alternate routing capabilities between all centers. Concentrating or multiplexing should also be considered at major air terminals. Results of this task also provide feedback on the data communications impact of the concepts related to center backup and terminal consolidation. A.R.H.

**N82-14808#** University of Southern California, Los Angeles. Electronic Sciences Lab.
**ANALYSIS AND DESIGN OF FAULT-TOLERANT COMPUTER SYSTEMS Final Technical Report, 1 Jul. 1977 - 30 Jun. 1981**
John P Hayes 15 Aug. 1981 26 p refs
(Grant AF-AFOSR-3352-77; AF Proj. 2304)
(AD-A105491; AFOSR-81-0671TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

This is the final report of a four-year investigation of fault-tolerant computer systems. A comprehensive theory of fault tolerance for a class of computer interconnection networks called beta-networks was developed. Reconfiguration and recovery strategies in multiprocessor systems were studied using graph theoretical models. The testing requirements of bit-sliced computers were investigated, and a new approach to the design of easily testable bit-sliced systems was developed. The testing of complex LSI/VLSI systems was examined using a high-level and expandable representation of test data called vector sequences. Author (GRA)

**N82-14809#** Harvard Univ., Cambridge, Mass. Center for Research in Computer Technology.
**FUNCTIONALLY SPECIALIZED MULTI-PROCESSOR ARCHITECTURES Final Report**
15 Aug. 1981 19 p ref
(Contract N00014-76-C-0914)
(AD-A105662) Avail: NTIS HC A02/MF A01 CSCL 09/2

This report summarizes the results obtained in the various areas of research as well as some of the key publications that resulted from the work. The research strategy pursued areas where, in our opinion, fundamental generalizations of the current knowledge base for computing system design was required. The areas in question are as follows: Data management, Resource management, Network management, and CPU architectures. GRA

**N82-14810#** Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
**A LOWER BOUND FOR THE TIME TO ASSURE INTERACTIVE CONSISTENCY**
Michael J. Fischer (Yale Univ.) and Nancy A. Lynch Sep. 1981 10 p refs
(Contracts DAAG29-79-C-0155; N00014-79-C-0873; N00014-80-C-0221; Grants NSF MCS-77-25628; NSF MCS-77-02474; NSF MCS-80-03337)
(AD-A105946; GIT-ICS-81/13; ARO-16451.12-EL) Avail: NTIS HC A02/MF A01 CSCL 09/2

The problem of 'assuring interactive consistency' is defined in (PSL). It is assumed that there are n isolated processors, of which at most m are faulty. The processors can communicate by means of two-party messages, using a medium which is reliable and of negligible delay. The sender of a message is always identifiable by the receiver. Each processor p has a private value sigma(p). The problem is to devise an algorithm that will allow each processor p to compute a value for each processor r, such that (a) if p and r are nonfaulty then p computes r's private value sigma(r), and (b) all the nonfaulty processors compute the same value for each processor r. It is shown in (PSL) that if $n < 3m + 1$, then there is no algorithm which assures interactive consistency. On the other hand, if $n > or = 3m + 1$, then an algorithm does exist. The algorithm presented in (PSL) uses $m + 1$ rounds of communication, and thus can be said to require 'time' $m + 1$. An obvious question is whether fewer rounds of communication suffice to solve the problem. In this paper, we answer this question in the negative. That is, we show that any algorithm which assures interactive consistency in the presence of m faulty processors requires at least $m + 1$ rounds of communication. Author (GRA)

**N82-14811#** Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
**DEVELOPMENT OF A METHODOLOGY FOR THE DETECTION OF SYSTEM FAILURES AND FOR THE DESIGN OF FAULT-TOLERANT CONTROL SYSTEMS Progress Report, 1 Oct. 1980 - 30 Sep. 1981**
Alan S. Willsky and Edward Y. Chow Jul. 1981 36 p refs (Contract N00014-77-C-0224)
(AD-A105900; LIDS-SR-1145; LIDS-P-1109; PR-5) Avail: NTIS HC A03/MF A01 CSCL 09/2

A brief description of the research on Information and Decision Systems is described. The scope of this contract is the development of an overall failure detection system design methodology and of methods for fault-tolerant control. We overview the research that has been performed in these areas during the indicated time period. A list of the papers and reports that have been and are being written as a result of research performed under this contract are included. GRA

**N82-14812#** Engins Matra, Velizy (France). Lab. Connection Reseaux.
**FABRICATION OF A PROCESSOR ADAPTED TO NUMERICAL FILTERING [REALISATION D'UN PROCESSEUR ADAPTE AU FILTRAGE NUMERIQUE]**
Nadia Karouche and Denis Jelsh 1981 121 p refs In FRENCH
(TEL/KAR/81) Avail: NTIS HC A06/MF A01

A fast universal processor able to carry out numerical filtering operations in real time was designed and built. Two filtering algorithms were considered: transversal filtering (finite impulse response); and recursive filtering (infinite impulse response). The feasibility of such a universal structure demonstrated. However, only the transversal filter could be realized, based on a microprocessor architecture. Performance of the filter is satisfactory. Author (ESA)

**N82-14813#** SRI International Corp., Menlo Park, Calif.
**DIRECTIONS FOR FUTURE RESEARCH AND DEVELOPMENT IN MULTICOMPUTER SYSTEMS Final Report, Jun. 1981**
Peter G. Neumann, David H. Brandin, Joseph A. Goguen, Jack Goldberg, and Michael A. Placko Bonn Bundesministerium fuer Forschung und Technologie Sep. 1981 110 p refs Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-81-003; ISSN-0170-9011) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 21,90

Research into multiprocessors, dispersed networks, local networks and distributed systems, data flow systems, highly parallel and internally concurrent systems, secure systems, and reliable and fault tolerant systems were surveyed. Multicomputer architectures are reviewed. The impact of programming languages on architecture, and vice versa, is considered. Theoretical computation models needed for describing systems are presented. Author (ESA)

**N82-14814** Stanford Univ., Calif.
**SYNTHESIS AND OPTIMIZATION OF PROGRAMMABLE LOGIC ARRAYS Ph.D. Thesis**
Sungho Kang 1981 228 p
Avail: Univ. Microfilms Order No. 8124091

Programmable logic arrays minimization algorithms are discussed based on products, inputs and outputs. A heuristic produce minimization algorithm based on iterative improvement is analyzed and the improvement of its efficiency is studied. The algorithm proposed is efficient enough to accept large switching functions whose minimization is inconceivable with previous algorithms. Several input and output minimization techniques and algorithms are discussed in detail. PLA partitioning algorithms are discussed and results show that by replacing a large PLA by several smaller PLA's, a reduced chip area can be achieved. The algorithms presented are heuristic and based on the concept of independence of internal PLA patterns. An automatic PLA synthesis procedure from a register transfer level language was developed. The synthesis procedure proposed uses a PLA for implementing the control circuit of the system. Dissert. Abstr.

**N82-14815** California Univ., Los Angeles.
**COMPUTER AIDED DESIGN AND RELIABILITY OF A GENERAL LSI LOGIC STRUCTURE FOR CUSTOM VLSI Ph.D. Thesis**
Michael Wayne Sievers 1981 214 p
Avail: Univ. Microfilms Order No. 8122838

The design and reliability issues to be faced in very large scale integration (VLSI) systems are investigated. A highly regular array, called a general logic structure, is presented as a means for not only simplifying the design problem but also as a means to limit failure mechanisms to a well defined set. This lattice attribute is essential for the design of testable or fault tolerant VLSI. A computer aided design system is also presented for the structure. Dissert. Abstr.

# 61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

**N82-14816** Oregon State Univ., Corvallis.
**SPECIFICATION OF PARALLEL PROCESSING USING PRODUCTION SYSTEMS Ph.D. Thesis**
Mohammed G. Gazaly 1982 276 p
Avail: Univ. Microfilms Order No. 8124328

The use of production systems as a model of parallel processing was investigated in an effort to provide a suitable medium within which parallel processing systems can be systematically specified, analyzed, and designed. Some existing models of parallel processing are reviewed. Production systems are formally defined and their computation power demonstrated. Production system specification of synchronization policies of access to shared resources is systematically analyzed for compatibility, liveness and fairness. Systematic design procedures for specifying systems of competing concurrent processes which are guaranteed to be compatible, live and fair are developed. The property of maximal compatibility is investigated and a systematic procedure to derive implementations of the synchronization policy specifications within production systems is presented. Production systems are compared to the other parallel processing models. The interactions between the different properties of

synchronization policies, namely, maximal compatibility, liveness, and fairness are also investigated. Dissert. Abstr.

**N82-14817*#** California State Univ., Fullerton. Dept. of Management Science.
**REAL TIME SIMULATION OF COMPUTER-ASSISTED SEQUENCING OF TERMINAL AREA OPERATIONS Final Report, Jul. 1978 - Jan. 1981**
Roger G. Dear 31 Jan. 1981 115 p refs
(Contract NCA2-OR253-801)
(NASA-CR-166195) Avail: NTIS HC A06/MF A01 CSCL 09B

A simulation was developed to investigate the utilization of computer assisted decision making for the task of sequencing and scheduling aircraft in a high density terminal area. The simulation incorporates a desision methodology termed Constrained Position Shifting. This methodology accounts for aircraft velocity profiles, routes, and weight classes in dynamically sequencing and scheduling arriving aircraft. A sample demonstration of Constrained Position Shifting is presented where six aircraft types (including both light and heavy aircraft) are sequenced to land at Denver's Stapleton International Airport. A graphical display is utilized and Constrained Position Shifting with a maximum shift of four positions (rearward or forward) is compared to first come, first serve with respect to arrival at the runway. The implementation of computer assisted sequencing and scheduling methodologies is investigated. A time based control concept will be required and design considerations for such a system are discussed. Author

**N82-14818*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**GRID SYSTEMS FOR EARTH RADIATION BUDGET EXPERIMENT APPLICATIONS**
David R. Brooks Dec. 1981 42 p refs
(NASA-TM-83233; L-14843) Avail: NTIS HC A03/MF A01 CSCL 09B

Spatial coordinate transformations are developed for several global grid systems of interest to the Earth Radiation Budget Experiment. The grid boxes are defined in terms of a regional identifier and longitude-latitude indexes. The transformations associate longitude with a particular grid box. The reverse transformations identify the center location of a given grid box. Transformations are given to relate the rotating (Earth-based) grid systems to solar position expressed in an inertial (nonrotating) coordinate system. The FORTRAN implementations of the transformations are given, along with sample input and output. Author

**N82-14819*#** Technology, Inc., Houston, Tex. Life Sciences Div.
**LABORATORY DATA MANIPULATION TOOLS BASIC DATA HANDLING PROGRAMS. VOLUME 2: DETAILED SOFTWARE/HARDWARE DOCUMENTATION Final Report**
30 Sep. 1981 187 p refs
(Contract NAS9-14880)
(NASA-CR-167478-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 09B

The set of computer programs described allows for data definition, data input, and data transfer between the LSI-11 microcomputers and the VAX-11/780 minicomputer. Program VAXCOM allows for a simple method of textual file transfer from the LSI to the VAX. Program LSICOM allows for easy file transfer from the VAX to the LSI. Program TTY changes the LSI-11 operators console to the LSI's printing device. Program DICTIN provides a means for defining a data set for input to either computer Program DATAIN is a simple to operate data entry program which is capale of building data files on either machine. Program LEDITV is an extremely powerful, easy to use, line oriented text editor. Program COPYSBF is designed to print out textual files on the line printer without character loss from FORTRAN carriage control or wide record transfer. A.R.H.

**N82-14820#** Rockwell International Corp., Richardson, Tex.
**COMPUTER PROGRAM TO SUPPORT REMOTE MANIPULATOR SYSTEM FLIGHT PLANNING ANALYSIS**
[1982] 151 p
Avail: NTIS HC A08/MF A01 CSCL 09B

The basic flight control software functions for the Remote Manipulator Flight Control System (RMS) were programmed for the Hewlett-Packard desk top computer mode HP-9845. This provides an engineering analysis tool for flight planning as well as to support the generation of level C flight parametes. The logic described is intended for onboard computer code but is also used for the flight planning/level C parameter generation exercises. The Kinematic Data Generation (KDG) function calculates point of resolution (POR) position and rate components from joint angles and rates. The Inverse Trigonometric Function (ITF) logic solves for a set of angles from a given POR position vector and a set of attitude angles. The analysis strategy starts with a desired end of trajectory position and orientation of the end effector nd uses the ITF logic to find the end of trajectory values at the six joint angles. Then with the help of a set of initial joint angles, the time history of desired joint angles is calculated which moves along a desired trajectory using the KDG logic. R.D.F.

**N82-14821#** Naval Postgraduate School, Monterey, Calif.
**VOICE RECOGNITION AS AN INPUT MODALITY FOR THE TACCO PREFLIGHT DATA INSERTION TASK IN THE P-3C AIRCRAFT M.S. Thesis**
John Laughlin Taggart, Jr. and Charles Darwin Wolfe Mar. 1981 150 p refs
(AD-A105568) Avail: NTIS HC A07/MF A01 CSCL 09/2

An experiment was conducted to compare accuracy and entry speed capabilities of a standard keyboard with the Threshold Technology T-600 voice recognition unit in the performance of an operational data entry task in the P-3C aircraft. A computer program was written to simulate the data entry capabilities of the P-3C operational software. Thirteen military officers executed a P-3C Tactical Coordinator's preflight task of entering data into the Stores Management and Navigation Preflight tableaux. Overall, voice entry was found to be faster for the Stores Management data entry task and slower for the Navigation Preflight tableau task, with comparable accuracy. But, for subjects with prior voice input experience, voice input was faster than keyboard entry for both tableaux. Author (GRA)

**N82-14822#** Polytechnic Inst. of New York, Brooklyn.
**SOFTWARE MODELING STUDIES EXECUTIVE SUMMARY Final Technical Report, Jan. 1978 - Oct 1980**
Martin L. Shooman and Henry Ruston Griffiss AFB, N.Y. RADC Jul. 1981 80 p refs
(Contract F30602-78-C-0057; AF Proj. 2304)
(AD-A105810; POLY-EE80-006; RADC-TR-81-183-Vol-1) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report documents the research performed under RADC Contract by Polytechnic Institute of New York in the area of complexity measures, test models and techniques, methods for developing programs with low error content, software reliability models and software management models. In this volume research described in previous progress reports, technical reports and in Volumes 2, 3, and 4 is summarized. Unfinished work, not previously reported, is described. Significant results are highlighted with their interrelation and potential. Author (GRA)

**N82-14823#** Princeton Univ., N. J. Dept. of Statistics.
**GEOMETRIC DATA ANALYSIS: AN INTERACTIVE GRAPHICS PROGRAM FOR SHAPE COMPARISON**
Andrew F. Siegel Apr. 1981 32 p refs
(Contract DAAG29-79-C-0205)
(AD-A105858; TR-193-SER-2; ARO-16669.11-M) Avail: NTIS HC A03/MF A01 CSCL 09/2

Two shapes, each consisting of n homologous points, can be rotated, scaled, and translated to obtain a close fit to each other by several methods. An interactive graphical computer program is presented that implements two methods: least squares and repeated medians, a robust method. Examples are given and the use of the system is discussed. Author (GRA)

**N82-14824#** Polytechnic Inst. of New York, Brooklyn.
**SOFTWARE MODELING STUDIES EXPERIMENTAL STUDY OF A TWO DIMENSIONAL LANGUAGE VERSUS FORTRAN FOR FIRST-COURSE PROGRAMMERS, VOLUME 3 Final Technical Report, Jan. 1978 - Oct. 1980**
Melvin Klerer Griffiss AFB, N.Y. RADC Jul. 1981 81 p refs

(Contract F30602-78-C-0057; AF Proj. 2304)
(AD-A106034; RADC-TR-81-183-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 09/2

The purpose of this study was to obtain quantitative measures of the relative performance of two very different programming languages. One language was FORTRAN and the other was the Klerer-May two dimensional language. The report describes the experiments conducted, presents the experimental results and provides a discussion of the results obtained. Author (GRA)

**N82-14825#** Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
**COMPUTER PROGRAM FOR SOLVING AN INVERSE PROBLEM WITH ONE VARIABLE: PART 1: METHODOLOGY [LOGICIEL DE RESOLUTION D'UN PROBLEME INVERSE A 1 VARIABLE. 1: EXPOSE DES METHODES]**
C. Delannoy, F. Lefeuvre, and C. R. P. E. Orleans Mar. 1981 42 p refs In FRENCH 2 Vol.
(CRPE-NT-80-Vol-1) Avail: NTIS HC A03/MF A01

A nonnegative real function of one real variable is determined, using computer programming that integrates a certain number of known linear functionals. The program wants a maximum entropy solution. An approximation is made either through discretization or by finding a mean solution, i.e. the Dirichlet kernel. The program is capable of four operations: finding a discrete solution; finding a mean solution; finding a maximum entropy solution, initiated by and finding a maximum entropy solution, user interactively initiated. Random electromagnetic wave fields were analyzed with good results. Author (ESA)

**N82-14826#** Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
**COMPUTER PROGRAM FOR SOLVING AN INVERSE PROBLEM WITH ONE VARIABLE. PART 2: USER MANUAL [LOGICIEL DE RESOLUTION D'UN PROBLEME INVERSE A 1 VARIABLE. 2: DOCUMENTATION D'UTILISATION]**
C. Delannoy and F. Lefeuvre Apr. 1981 41 p refs In FRENCH 2 Vol.
(CRPE-NT-81-Vol-2) Avail: NTIS HC A03/MF A01

The program is capable of four operations: (1) finding a discrete solution; (2) finding a mean solution; (3) find a maximum entropy solution, initiated by either (1) or (2); and (4) find a maximum entropy solution, user interactively initiated. The complete use of the program is explained, stressing the general nature of the software. A listing is shown for the numerical integration of five kernel functions. Author (ESA)

**N82-14827** California Univ., Los Angeles.
**THE DESIGN, SPECIFICATION, AND IMPLEMENTATION OF OBJ-T: A LANGUAGE FOR WRITING AND TESTING ABSTRACT ALGEBRAIC PROGRAM SPECIFICATIONS Ph.D. Thesis**
Joseph John Tardo 1981 269 p
Avail: Univ. Microfilms Order No. 8122865

The application of algebraic techniques to the problem of generating formal program specifications is investigated. The design, implementation, and application of OBJ-T, a formal language for writing and testing abstract algebraic program specifications is described. A conceptually simple and elegant semantic foundation for OBJ-T which reflects the simplicity of its syntax is used. The language is based upon a data oriented, initial algebra model f computation. The mathematical foundations of this algebraic model are described and then used to characterize the mathematical semantics of OBJ-T. Dissert. Abstr.

**N82-14828** Iowa Univ., Oakdale.
**AN INVESTIGATION INTO THE CURRENT ATTITUDES AND PERCEPTIONS HELD BY EDUCATORS TOWARD COMPUTER-ASSISTED-INSTRUCTION Ph.D. Thesis**
Diedrus Uvonne Brown 1981 164 p
Avail: Univ. Microfilms Order No. 8123303

In order to determine the current attitudes and perceptions of educators toward computer assisted instruction (CAL), an instrument which consisted of eight questions was designed to ascertain background information on each participant, and the extent of CAL use in their particular school. Also, the survey instrument consisted of forty carefully scrutinized ideas, opinions, and/or conclusions found in the relevant literature in this area. It was concluded that educators, regardless of position, hold similar attitudes and perceptions toward CAL, that age had no significant bearing on how educators view CAL, and that if, in fact, there were varying attitudes, it would be in the general area of how CAL and/or computers affect students and how educators themselves view CAL and/or computers.
Dissert. Abstr.

**N82-14151#** European Space Operations Center, Darmstadt (West Germany).
**SOFTWARE FOR THE RESCUE OF NONNOMINAL MISSIONS**
Guy Janin *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 281-283 ref (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14169#** Science Research Council, Chilton (England). Rutherford and Appleton Labs.
**ACS PERFORMANCE VERTIFICATION FOR IRAS: SOFTWARE ENGINEERING AT THE OPERATIONS CONTROL CENTRE**
L. P. Baldwin *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 443-450 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 62 COMPUTER SYSTEMS

Includes computer networks.

**N82-14829*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
**RUGGEDIZED MINICOMPUTER HARDWARE AND SOFTWARE TOPICS, 1981: PROCEEDINGS OF THE 4TH ROLM MIL-SPEC COMPUTER USER'S GROUP CONFERENCE**
Dec. 1981 214 p refs Conf. held in San Diego, Calif., 22-25 Feb. 1981
(NASA-CP-2206; L-14886) Avail: NTIS HC A11/MF A01 CSCL 09B

Presentations of a conference on the use of ruggedized minicomputers are summarized. The following topics are discussed: (1) the role of minicomputers in the development and/or certification of commercial or military airplanes in both the United States and Europe; (2) generalized software error detection techniques; (3) real time software development tools; (4) a redundancy management research tool for aircraft navigation/flight control sensors; (5) extended memory management techniques using a high order language; and (6) some comments on establishing a system maintenance scheme. Copies of presentation slides are also included. For individual titles, see N82-14830 through N82-14842.

**N82-14830*#** Boeing Commercial Airplane Co., Seattle, Wash.
**AIRBORNE DATA ANALYSIS/MONITOR SYSTEM**
Darryl B. Stephison *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 1-21 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

An Airborne Data Analysis/Monitor System (ADAMS), a ROLM 1666 computer based system installed onboard test airplanes used during experimental testing is evaluated. In addition to the 1666 computer, the ADAMS hardware includes a DDC System 90 fixed head disk and a Miltape DD400 floppy disk. Boeing designed a DMA interface to the data acquisition system and an intelligent terminal to reduce system overhead and simplify operator commands. The ADAMS software includes RMX/RTOS and both ROLM FORTRAN and assembly language are used. The ADAMS provides real time displays that enable onboard test engineers to make rapid decisions about test conduct thus reducing the cost and time required to certify new model airplanes, and improved the quality of data derived from the test, leading to more rapid development of improvements resulting in quieter, safer, and more efficient airplanes. The availability of airborne data processing removes most of the weather and geographical

restrictions imposed by telemetered flight test data systems. A data base is maintained to describe the airplane, the data acquisition system, the type of testing, and the conditions under which the test is performed. M.D.K.

**N82-14831*#** Boeing Commercial Airplane Co., Seattle, Wash.
**ADAMS EXECUTIVE AND OPERATING SYSTEM**
W. D. Pittman *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 23-31 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

The ADAMS Executive and Operating System, a multitasking environment under which a variety of data reduction, display and utility programs are executed, a system which provides a high level of isolation between programs allowing them to be developed and modified independently, is described. The Airborne Data Analysis/Monitor System (ADAMS) was developed to provide a real time data monitoring and analysis capability onboard Boeing commercial airplanes during flight testing. It inputs sensor data from an airplane performance data by applying transforms to the collected sensor data, and presents this data to test personnel via various display media. Current utilization and future development are addressed. M.D.K.

**N82-14832*#** Boeing Commercial Airplane Co., Seattle, Wash.
**SYSTEM PERFORMANCE ANALYZER**
H. R. Helbig *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 33-46 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

The System Performance Analyzer (SPA) designed to provide accurate real time information about the operation of complex systems and developed for use on the Airborne Data Analysis/Monitor System (ADAMS), a ROLM 1666 based system is described. The system uses an external processor to operate an intelligent, simulated control panel. Also provided are functions to trace operations, determine frequency of use of memory areas, and time or count user tasks in a multitask environment. This augments the information available from the standard debugger and control panel, and reduces the time and effort needed by ROLM 1666 users in optimizing their system, as well as providing documentation of the effect of any changes. The operation and state of the system are evaluated. M.D.K.

**N82-14833*#** Societe Nationale Industrielle Aerospatiale, Toulouse (France). Flight Test Management Dept.
**ON-BOARD COMPUTER PROGRESS IN DEVELOPMENT OF A 310 FLIGHT TESTING PROGRAM**
Pierre Reau *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 47-57 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

Onboard computer progress in development of an Airbus A 310 flight testing program is described. Minicomputers were installed onboard three A 310 airplanes in 1979 in order to: (1) assure the flight safety by exercising a limit check of a given set of parameters; (2) improve the efficiency of flight tests and allow cost reduction; and (3) perform test analysis on an external basis by utilizing onboard flight types. The following program considerations are discussed: (1) conclusions based on simulation of an onboard computer system; (2) brief descriptions of A 310 airborne computer equipment, specifically the onboard universal calculator (CUB) consisting of a ROLM 1666 system and visualization system using an AFIGRAF CRT; (3) the ground system and flight information inputs; and (4) specifications and execution priorities for temporary and permanent programs. M.D.K.

**N82-14834*#** Naval Material Command, Washington, D. C. Office of the Executive Director for Acquisition.
**NEW STARTS IN RESEARCH AND DEVELOPMENT, 1982**
Joseph Grosson *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 59-107 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

An outline in slide form, of some areas of U.S. Navy research and development utilizing airborne minicomptuers is presented. The following program considerations are addressed: (1) research and engineering management; (2) budgeting; (3) equipment specifications and construction materials; (4) computer applications; (5) technological capabilities, utilization, and transfer; and (6) military applications. M.D.K.

**N82-14835*#** Comptek Research, Inc., Santa Barbara, Calif.
**SOFTWARE ERROR DETECTION**
Wolfgang Buechler and A. Gilliam Tucker *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 109-114 refs (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

Several methods were employed to detect both the occurrence and source of errors in the operational software of the AN/SLQ-32. A large embedded real time electronic warfare command and control system for the ROLM 1606 computer are presented. The ROLM computer provides information about invalid addressing, improper use of privileged instructions, stack overflows, and unimplemented instructions. Additionally, software techniques were developed to detect invalid jumps, indices out of range, infinte loops, stack underflows, and field size errors. Finally, data are saved to provide information about the status of the system when an error is detected. This information includes I/O buffers, interrupt counts, stack contents, and recently passed locations. The various errors detected, techniques to assist in debugging problems, and segment simulation on a nontarget computer are discussed. These error detection techniques were a major factor in the success of finding the primary cause of error in 98% of over 500 system dumps. M.D.K.

**N82-14836*#** Command Control and Communications Corp., Torrance, Calif.
**ARTS BETA TESTING REPORT**
Michael C. McCune *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 115-132 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

The advanced real time system (ARTS) was tested utilizing existing commercial system hardware and software which has been operating under advanced operating system (AOS) for several years in a multitasking, multiprocessing, and multiple computer environment. Experiences with ARTS in terms of compatibility with AOS, ease of transmission between AOS and ARTS, and functional areas of ARTS which were tested are discussed. Relative and absolute performance of ARTS versus AOS as measured in the system environment are also presented. S.L.

**N82-14837*#** E-Systems, Inc., Falls Church, Va. Melpar Div.
**REAL TIME SOFTWARE TOOLS AND METHODOLOGIES**
M. J. Christofferson *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 133-149 ref (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

Real time systems are characterized by high speed processing and throughput as well as asynchronous event processing requirements. These requirements give rise to particular implementations of parallel or pipeline multitasking structures, of intertask or interprocess communications mechanisms, and finally of message (buffer) routing or switching mechanisms. These mechanisms or structures, along with the data structure, describe the essential character of the system. These common structural elements and mechanisms are identified, their implementation in the form of routines, tasks or macros - in other words, tools are formalized. The tools developed support or make available the following: reentrant task creation, generalized message routing techniques, generalized task structures/task families, standardized intertask communications mechanisms, and pipeline and parallel processing architectures in a multitasking environment. Tools development raise some interesting prospects in the areas of software instrumentation and software portability. These issues are discussed following the description of the tools themselves. S.L.

**N82-14838*#** E-Systems, Inc., Falls Church, Va. Melpar Div.
**USE OF SOFTWARE TOOLS IN THE DEVELOPMENT OF REAL TIME SOFTWARE SYSTEMS**

Robert C. Garvey *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 151-169 ref (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

The transformation of a preexisting software system into a larger and more versatile system with different mission requirements is discussed. The history of this transformation is used to illustrate the use of structured real time programming techniques and tools to produce maintainable and somewhat transportable systems. The predecessor system is a single ground diagnostic system; its purpose is to exercise a computer controlled hardware set prior to its deployment in its functional environment, as well as test the equipment set by supplying certain well known stimulas. The successor system (FTE) is required to perform certain testing and control functions while this hardware set is in its functional environment. Both systems must deal with heavy user input/output loads and a new I/O requirement is included in the design of the FTF system. Human factors are enhanced by adding an improved console interface and special function keyboard handler. The additional features require the inclusion of much new software to the original set from which FTF was developed. As a result, it is necessary to split the system into a duel programming configuration with high rates of interground communications. A generalized information routing mechanism is used to support this configuration. S.L.

**N82-14839*#** National Aerospace Lab., Amsterdam (Netherlands).
**ROLM COMPUTERS IN THE FLIGHT TESTING OF THE FOKKER F29 AIRCRAFT**
P. J. Manders *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 171-192 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

The design, development, installation, and operation of the test equipment (MRVS) is discussed. The main feature of the MRVS is continuous recording on an instrumentation recorder data of up to 1500 parameters with a total sample rate of up to 10,000 samples per second. In order to compress the evaluation and calibration time period, the following additional requirements were set for two test systems: (1) recording of selected parameters, time tagged on computer compatible tape (CCT); (2) recording of selected high bandwidth signals and ad hoc parameters on analog tape; (3) onboard presentation of calibrated parameter data, in engineering units, in numerical as well as graphical form for: system checkout during pre-, in- and post-flight, and quick look analysis during in-flight; (4) real time presentation on the ground by telemetry for: flight monitoring, takeoff and landing measurements, and noise measurements; and (5) data processing on the ground on the Fokker-NLR computer network. S.L.

**N82-14840*#** Westinghouse Electric Corp., Baltimore, Md.
**FAULT ISOLATION TECHNIQUES**
Al Dumas *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 193-196 (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

Three major areas that are considered in the development of an overall maintenance scheme of computer equipment are described. The areas of concern related to fault isolation techniques are: the programmer (or user), company and its policies, and the manufacturer of the equipment. S.L.

**N82-14841*#** GTE Sylvania, Inc., Mountain View, Calif.
**EXTENDED MEMORY MANAGEMENT UNDER RTOS**
Mark Plummer *In* NASA. Langley Research Center Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 197-207 ref (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

A technique for extended memory management in ROLM 1666 computers using FORTRAN is presented. A general software system is described for which the technique can be ideally applied. The memory manager interface with the system is described. The protocols by which the manager is invoked are presented, as well as the methods used by the manager. S.L.

**N82-14842*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va. Flight Electronics Div.
**DESCRIPTION OF A DUAL FAIL OPERATIONAL REDUNDANT STRAPDOWN INERTIAL MEASUREMENT UNIT FOR INTEGRATED AVIONICS SYSTEMS RESEARCH**
W. H. Bryant and F. R. Morrell *In its* Ruggedized Minicomputer Hardware and Software Topics, 1981 Dec. 1981 p 209-217 refs (For primary document see N82-14829 05-62)
Avail: NTIS HC A11/MF A01 CSCL 09B

An experimental redundant strapdown inertial measurement unit (RSDIMU) is developed as a link to satisfy safety and reliability considerations in the integrated avionics concept. The unit includes four two degree-of-freedom tuned rotor gyros, and four accelerometers in a skewed and separable semioctahedral array. These sensors are coupled to four microprocessors which compensate sensor errors. These microprocessors are interfaced with two flight computers which process failure detection, isolation, redundancy management, and general flight control/navigation algorithms. Since the RSDIMU is a developmental unit, it is imperative that the flight computers provide special visibility and facility in algorithm modification. S.L.

**N82-14843** Oregon State Univ., Corvallis.
**MIKE: A NETWORK OPERATING SYSTEM FOR THE DISTRIBUTED DOUBLE-LOOP COMPUTER NETWORK Ph.D. Thesis**
Duen-Ping Tsay 1981 151 p
Avail: Univ. Microfilms Order No. 8121864

A network operating system called Multicomputer Integrator Kernel (MIKE) and its supporting architecture is proposed for use in distributed systems in general and in the Distributed Double Loop Computer Network in particular. The system provides system transparent operation for users and maintains cooperative autonomy among local hosts. Its underlying architecture provides additional hardware/firmware mechanisms to support the logical structure of MIKE. Modern operating system design principles used to cope with complexity and vulnerability include data abstraction, capability based addressing, and domain based protection. The use of these concepts contributes to several characteristics whose presence is essential in a distributed environment. Among these characteristics are extensibility/configurability, reliability/robustness, system transparency, and local autonomy. Dissert. Abstr.

**N82-14844** California Univ., Los Angeles.
**SCHEME OF ATTRIBUTES IN MULTILEVEL DESIGN OF COMPUTER SYSTEMS Ph.D. Thesis**
Antonio Benedito Coimbra Sampaio 1981 456 p
Avail: Univ. Microfilms Order No. 8122835

Abstraction and checking methods which are supported by a scheme called the scheme of attributes are defined. The methods can be used to enhance design methodologies towards producing correct computer systems. The abstraction method is similar to data abstraction techniques currently used to specify, design, and verify programs. The abstraction method is used to formally specify hardware building blocks (a multiplexer AM25LS157 and the microprocessor AM2930) and to illustrate composition of hardware systems from building blocks. The basic strategy of the check method is to identify primitive attributes of computer structures and the rules regulating their use, so that inconsistencies can be uncovered early by detecting rule violations when operating on attributes used in the design of a system. The check method also uses the notion of synthesized and inherited attributes of Knuthian semantics in order to derive attributes of a computer structure from attributes associated with computer structures at the same level or at lower levels, therefore allowing multilevel checks. Dissert. Abstr.

**N82-14845** California Univ., Los Angeles.
**FLOW CONTROL IN STORE-AND-FORWARD COMPUTER NETWORK Ph.D. Thesis**
Chong-Wei Tseng 1981 109 p
Avail: Univ. Microfilms Order No. 8122871

The broad area of flow control and sequencing in computer communication networks was studied. A special case of message sequencing is shown to reduce a Markov process. An end-to-end flow control scheme is shown for use in computer communication networks that can be modeled as a closed network of queues.

A flow control scheme based on limiting the permit generation rates is also analyzed. This effective scheme involves essentially no computational complexity thus enabling measurement and adjustment of the network performance with little difficulty. The simplicity also allows incorporaton of more realistic aspects of network protocols such as piggy-back acknowledgement, time-out, and gate functions in analysis. Two simple but effective distributed dynamic flow control schemes are proposed and analyzed. With either of these two schemes, a network is shown to respond well to the dynamically changing environment. Dissert. Abstr.

# 63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

**N82-14846#** Naval Ocean Systems Center, San Diego, Calif.
**C2 RELEVANCE OF SELECTED ARTIFICIAL INTELLIGENCE SYSTEMS. BRIEF EXAMINATION OF SEVERAL EXISTING AL SYSTEMS FOR USE IN FUTURE COMMAND AND CONTROL APPLICATIONS Interim Report, 1 Oct. 1980 - 30 Apr. 1981**
R. J. Bechtel 7 Jul. 1981 26 p refs
(XF21241100)
(AD-A105876; NOSC/TR-706) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report provides a very brief examination of several existing artificial intelligence systems which have been judged to be worth further investigation for use in future command and control applications. It represents the current state of an ongoing process which began with a much longer list of artificial intelligence systems. Each system on the long list was given a very quick evaluation on scales measuring availability, applicability, and maturity. Within each broad category of artificial intelligence effort (e.g. natural language, inference) the highest ranking systems were selected for further examination. This is the result of that examination. Author (GRA)

**N82-14847#** Brown Univ., Providence, R. I. Center for Dynamical Systems.
**NUMERICAL METHODS AND APPROXIMATION AND MODELLING PROBLEMS IN STOCHASTIC CONTROL THEORY Final Report, 1 Jul. 1980 - 30 Jun. 1981**
Harold J. Kushner and Wendell H. Fleming 20 Aug. 1981 4 p
(Grant AF-AFOSR-3063-76; AF Proj. 2304)
(AD-A105490; AFOSR-81-0672TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report summarizes the results of research produced under this grant, and lists titles of papers produced. Author (GRA)

**N82-14145#** Instituto de Pesquisas Espaciais, Sao Paulo (Brazil). Inst. de Pesquisas Espacias.
**OPTIMAL LINEAR ESTIMATION AND SUBOPTIMAL NUMERICAL SOLUTIONS OF DYNAMICAL SYSTEMS CONTROL PROBLEMS**
Atair Rios Neto and Luiz A. Waack Bambace *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 233-237 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

**N82-14146#** Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
**LINEAR PROGRAMMING AND SUBOPTIMAL SOLUTIONS OF DYNAMICAL SYSTEMS CONTROL PROBLEMS**
Decio Castilho Ceballos and Atair Rios Neto *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 239-243 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

# 64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

**N82-14848** California Univ., Santa Cruz.
**NORMAL FORMS, VERSAL DEFORMATIONS AND QUADRATIC INTEGRALS OF LINEAR HAMILTONIAN SYSTEMS Ph.D. Thesis**
Huseyin Kocak 1980 171 p
Avail: Univ. Microfilms Order No. 8123242

Equivalence classes of time independent, linear, real Hamiltonian systems can be identified, up to canonical transformations with the orbits of the adjoint action of the real symplectic group on its Lie albegra. A set of representatives, also called normal forms, for those orbits is given. Versal deformations of systems in normal form are constructed. Bifurcation diagrams of system in general position with small codimension are calculated. Also centralizers of elements of the real symplectic algebra are explicitly found. Finally, a proof of a theorem of Williamson is presented: any linear real Hamiltonian set of differential equations is completely integrable with quadratic integrals. Dissert. Abstr.

**N82-14849*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**APPLICATION OF INTEGRATION ALGORITHMS IN A PARALLEL PROCESSING ENVIRONMENT FOR THE SIMULATION OF JET ENGINES**
Susan M. Krosel and Edward J. Milner 1982 25 p refs To be presented at the 15th Ann. Simulation Symp., Tampa, Fla., 17-19 Mar. 1982
(NASA-TM-82746; E-1059) Avail: NTIS HC A02/MF A01 CSCL 12A

The application of Predictor corrector integration algorithms developed for the digital parallel processing environment are investigated. The algorithms are implemented and evaluated through the use of a software simulator which provides an approximate representation of the parallel processing hardware. Test cases which focus on the use of the algorithms are presented and a specific application using a linear model of a turbofan engine is considered. Results are presented showing the effects of integration step size and the number of processors on simulation accuracy. Real time performance, interprocessor communication, and algorithm startup are also discussed. B.W.

**N82-14850#** Wisconsin Univ. - Madison. Dept. of Computer Sciences.
**BLOCK ITERATIVE METHODS FOR ELLIPTIC AND PARABOLIC DIFFERENCE EQUATIONS**
Seymour V. Parter and Michael Steuerwalt (Los Alamos Scientific Lab.) Sep. 1981 45 p refs
(Contracts W-7405-eng-36; N00014-76-C-0341; NR Proj. 044-356)
(AD-A105898; CSTR-447; LA-UR-812576) Avail: NTIS HC A03/MF A01 CSCL 12/1

Direct iterative methods for solving the linear system AX = Y split A into a difference M-N. By viewing N as a weak multiplication operator, the convergence rates of block direct iterative methods for elliptic and parabolic difference equations may be determined. The difference equations may arise from very general partial differential equations on general domains in m space dimensions. GRA

**N82-14851#** North Carolina Univ. at Chapel Hill.
**COMPACT COVARIANCE OPERATORS**
Charles R. Baker and Ian W. McKeague Aug. 1981 10 p refs
(Contract N00014-75-C-0491)
(AD-A105658) Avail: NTIS HC A02/MF A01 CSCL 12/1

The study of covariance operators is a major component in the theory of probability measures on Banach spaces. The covariance operators of a strong second-order measure is always compact however, the covariance operator of a weak second-order measure need not be compact. In this paper we first characterize series representations of covariance operators, and then give a set of necessary and sufficient conditions for a covariance operator to be compact. The classical Mercer's theorem can be

obtained as an immediate corollary. These results are then applied to extend a result of Prohorov and Sazanov on relative compactness of probability measures from Hilbert space to Banach space. GRA

**N82-14852#** Florida Univ., Gainesville. Center for Mathematical System Theory.

**RESEARCH IN APPLIED MATHEMATICS RELATED TO NONLINEAR SYSTEM THEORY Final Report, 10 Sep. 1977 - 31 Mar. 1981**

R. E. Kalman Sep. 1981 16 p refs

(Contract DAAG29-80-C-0050; Grant DAAG29-77-G-0225)

(AD-A106091; ARO-15077.26-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Special emphasis was given to the following areas: (1) Finite-dimensional linear system theory by algebraic methods: linear systems over a ring, algebraic methods in the study of feedback, polynomial methods for the study of linear systems, F mod G invariant subspaces; (2) Infinite-dimensional linear systems: realization theory of infinite-dimensional linear systems; (3) Nonlinear system theory: basic properties of polynomial (discrete-time) systems and their realization theory; and (4) Identification problems in economics: study of econometric model building. GRA

**N82-14853#** New Mexico Univ., Albuquerque. Dept. of Mathematics and Statistics.

**RESEARCH IN PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS Final Report, 1 Mar. 1976 - 30 Jun. 1981**

Alfred S. Carasso 30 Aug. 1981 7 p refs

(Grants DAAG29-76-G-0153; DAAG29-78-G-0091)

(AD-A105859; ARO-13355.5-M; ARO-15568.4-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The research deals with the analysis and efficient computation of several ill-posed initial value problems, linear and nonlinear. These problems originate in digital image restoration, plasma compression by magnetic pistons, and heat transfer in gun barrels. The analyses and computational algorithms developed are closely tied to the contextual origin of each problem studied. Author (GRA)

**N82-14854#** Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

**MATHEMATICAL SOFTWARE FOR LINEAR CONTROL AND ESTIMATION THEORY Final Report, 10 Feb. 1979 - 9 May 1981**

Virginia Klema 15 Sep. 1981 3 p

(Contract DAAG29-79-C-0031)

(AD-A106000; ARO-16257.3-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

The final report for the project, Mathematical Software for Linear Control and Estimation Theory, includes a list of publications, conference proceedings, and invited talks by the principal investigators. Emphasis throughout the project was placed on interdisciplinary work in control theory, numerical methods suitable for certain control problems and mathematical software to do the frequency response problem. Numerically stable methods were used, and portability of the mathematical software was stressed. Author (GRA)

**N82-14855#** University Coll. of Swansea (Wales). Dept. of Civil Engineering.

**HIERARCHICAL FINITE ELEMENT APPROACHES ERROR ESTIMATES AND ADAPTIVE REFINEMENT**

O. C. Zienkiewicz, D. W. Kelly, J. Gago, and I. Babuska (Maryland Univ.) Jul. 1981 36 p refs Presented at the Math. of Finite Elem. and Appl. MAFELAP 1981, Uxbridge, Engl., Apr. 1981 Sponsored in part by the Gulbenkian Foundation Lisbon and by Technical Univ. of Lisbon

(Contract N00014-77-C-0623)

(AD-A105899; C/R/382/81) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper is concerned with the identification of the discretization error in finite element solution and the definition of optimal refinement processes. The advantages and limitations of the hierarchical approach will be discussed and it will be shown how the intelligent enrichment of the finite element grid can be left to the computer if a capacity for a-posteriori error estimation exists within the finite element code. GRA

**N82-14856#** Maryland Univ., College Park. Computer Vision Lab.

**FAST PARALLEL EXACT COMPUTATION OF THE GENERALIZED INVERSE AND RANK OF A MATRIX**

E. V. Krishnamurthy Jul. 1981 10 p refs

(Grant AF-AFOSR-3271-77; AF Proj. 2304)

(AD-A105566; TR-1079; AFOSR-81-0659TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Based on the feet parallel matrix multiplication scheme of Krishnamurthy and Klette, O(log m) step algorithms using m matrix processors are described for the exact determination of the Moore-Penrose generalized inverse and the rank of an (MXM) matrix with integer entries. Author (GRA)

**N82-14857#** Naval Ship Research and Development Center, Bethesda, Md. Computation Mathematics/Logistics Dept.

**OPTIMIZATION OF REINFORCEMENT FOR A CLASS OF OPENINGS IN PLATE STRUCTURES Interim Report, Oct. 1980 - Aug. 1981**

Surendra K. Dhir Sep. 1981 21 p refs

(AD-A105718; DTNSRDC/CMLD-81-25) Avail: NTIS HC A02/MF A01 CSCL 12/1

A numerical/analytical procedure has been developed which yields the optimum amount of reinforcement for a given hole shape in a large elastic plate under prescribed boundary stresses. This procedure is based on determining the usual two complex potentials which describe the entire stress field, constructing the strain energy density function in terms of the unknown amount of reinforcement, integrating this function around the opening boundary, and finally minimizing this integral with respect to the reinforcement. The method is first developed for a general hole shape and then demonstrated in some detail for a circular and a square-like opening. Author (GRA)

**N82-14858#** Stanford Univ., Calif. Systems Optimization Lab.

**ON THE RELATIONSHIP BETWEEN THE HAUSDORFF DISTANCE AND MATRIC DISTANCES OF ELLIPSOIDS**

Alan J. Hoffman and Jean-Louis Goffin Aug. 1981 19 p refs

(Contracts N00014-75-C-0267; DE-AM03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MSC-76-81259; NSF MCS-79-26009; NSF ECS-80-12974)

(AD-A105880; SU-SOL-81-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

The space of ellipsoids may be metrized by the Hausdorff distance or by the sum of the distance between their centers and a distance between matrices. Various inequalities between metrices are established. It implies that the square root of positive semidefinite symmetric matrices satisfies a Lipschitz condition, with a constant which depends only on the dimension of the space. Author (GRA)

**N82-14859#** Stanford Univ., Calif. Systems Optimization Lab.

**EXACT AND APPROXIMATION ALGORITHMS FOR A SCHEDULING PROBLEM**

Gregory Dobson Jul. 1981 42 p refs

(Contracts N00014-75-C-0267; DE-AM03-76SF-00326; DE-AT03-76ER-72013; Grants NSF MCS-76-81259; NSF MCS-79-26009; NSF ECS-80-12974)

(AD-A105881; SU-SOL-81-9) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper discusses problems that arose in calendaring cases for an appellate court. The first problem is to distribute cases among panels of judges so as to equalize work loads. We give a worst case analysis of a heuristic for this NP-complete problem. For a given distribution denote by z the heaviest work load. We wish to minimize z. The ratio of the heuristic value z-bar to that of the true optimum $z^*$ is shown to be $\bar{z}/z^* < \text{or} = (k + 3)/(k + 2)$ where all the case weights in (0, $(1/k)z^*$), generalizing a result of Graham on multiprocessor scheduling. Under a restrictive assumption on the case weights, some generalizations of this scheduling problem are solved. Characterizations for feasible calendars and polynomial algorithms for finding these feasible solutions are given. Algorithms are

given for choosing an optimal subset of the backlogged cases that can be calendared. Author (GRA)

**N82-14860#** Stanford Univ., Calif.
**A FURTHER INVESTIGATION OF EFFICIENT HEURISTIC PROCEDURES FOR INTEGER LINEAR PROGRAMMING WITH AN INTERIOR**
Frederick S. Hillier Aug. 1981 66 p
(Contract N00014-76-C-0418; Grant NSF MCS-76-81259)
(AD-A106027; SU-SOL-81-11) Avail: NTIS HC A04/MF A01 CSCL 12/1

Some heuristic procedures for seeking a good approximate solution of any pure integer linear programming problem are evaluated. It was found that the procedures are extremely efficient, being computationally feasible for problems having hundreds of variables and constraints. Furthermore, they proved to be very effective in identifying good solutions, often obtaining optimal ones. Thus, the procedures provide a way of dealing with the frequently encountered integer programming problems that are beyond the computational capability of existing algorithms. For smaller problems, they also provide an advanced start for accelerating certain primal algorithms, including the author's Bound-and-Scan algorithm and Faaland and Hillier's Accelerated Bound-and-Scan algorithm. In addition, Jeroslow and Smith have found that imbedding the first part of one of these procedures inside the iterative step of a branch-and-bound algorithm can greatly improve the latter's efficiency in locating solutions whose objective function value is within a specified percentage of that for the optimal solution. GRA

**N82-14861#** Stanford Univ., Calif. Systems Optimization Lab.
**OPTIMIZATION OF UNCONSTRAINED FUNCTIONS WITH SPARSE HESSIAN MATRICES: QUASI-NEWTON METHODS**
Mukund N. Thapa Aug. 1981 40 p refs
(Contracts N00014-75-C-0267; DE-AM03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-76-81259; NSF MCS-79-26009; NSF ECS-80-12974)
(AD-A106028; SU-SOL-81-12) Avail: NTIS HC A03/MF A01 CSCL 12/1

Newton-type methods and quasi-Newton methods have proven to be very successful in solving dense unconstrained optimization problems. Recently there has been considerable interest in extending these methods to solving large problems when the Hessian matrix has a known a priori sparsity pattern. This paper treats sparse quasi-Newton methods in a uniform fashion and shows the effect of loss of positive-definiteness in generating updates. These sparse quasi-Newton methods coupled with a modified Cholesky factorization to take into account the loss of positive-definiteness when solving the linear systems associated with these methods were tested on a large set of problems. The overall conclusions are that these methods perform poorly in general-the Hessian matrix becomes indefinite even close to the solution and superlinear convergence is not observed in practice. Author (GRA)

**N82-14862#** Ecole Nationale Superieure de Techniques Avancees, Paris (France).
**LINEAR AND GEOMETRIC NONLINEAR ANALYSIS OF SHELLS BY AN ISOPARAMETRIC THREE DIMENSIONAL DEGENERATED ELEMENT Ph.D. Thesis [ANALYSE LINEAIRE ET NON LINEAIRE GEOMETRIQUE DES COQUES PAR ELEMENTS FINIS ISOPARAMETRIQUES TRIDIMENSIONNELS DEGENERES]**
G. Fezans (Ecole Nationale Superieure de l'Aeronautique et de l'Espace) Jan. 1981 256 p refs In FRENCH; ENGLISH summary
(Rept-140) Avail: NTIS HC A12/MF A01

The performances of quadratic and cubic, Serendip and Lagrange elements with normal and reduced integration are compared through plate and shell examples. The performances of these elements in the analysis of thin structures and the problems of numerical conditioning induced by their utilization in this domain are emphasized. The geometric nonlinear formulation of the isoparametric threedimensional degenerated elements is presented. A total Lagrangian formulation was used. The nonlinear problem is solved by a modified Newton-Raphson method with incremental loading. Examples of highly nonlinear problems demonstrate the effectiveness of the element. Author (ESA)

**N82-14863** California Univ., Los Angeles.
**FLOATING-POINT ON-LINE ARITHMETIC FOR HIGHLY CONCURRENT DIGIT-SERIAL COMPUTATION: APPLICATION TO MESH PROBLEMS Ph.D. Thesis**
Osaaki Watanuki 1981 165 p
Avail: Univ. Microfilms Order No. 8122880

Quasi-normalization, floating point algorithms for on-line arithmetic operations are presented. The properties of redundant number system in mantissa representation are studied and the range of redundant mantissa is derived by a method of error analysis. From the range of mantissa and the absolute error of on-line operations, the maximum relative representation error is defined and analyzed for redundant floating-point numbers. The developed floating point on-line algorithms were applied to a linear iterative method for solving the elliptic partial differential equations. It is shown that the bandwidth of the routing network of the array of processors is reduced by the digit serial computation using on-line arithmetic without degrading the performance. The performance is analyzed using speedup and effectiveness measures. Dissert. Abstr.

## 65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

**N82-14864#** Florida State Univ., Tallahassee. Dept. of Statistics
**NEW ESTIMATION METHODS FOR LOG-LINEAR MODELS**
Thomas C. Redman Aug. 1981 39 p refs
(Contracts N00014-76-C-0394; N00014-80-C-0093)
(AD-A105745; FSU-STATISTICS-M562; TR-151-ONR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Two new methods for estimation of parameters in log-linear models are proposed and their properties considered in this article. Conditions for the existence of the new estimators are derived, and the new estimators are shown to possess appropriate asymptotic properties. GRA

**N82-14865#** Florida State Univ., Tallahassee. Dept. of Statistics.
**PROPER BAYES MINIMAX ESTIMATORS FOR A MULTIVARIATE NORMAL MEAN WITH UNKNOWN COMMON VARIANCE UNDER A CONVEX LOSS FUNCTION**
Pi-Erh Lin and Amany Mousa Sep. 1981 31 p refs
(Contract N00014-80-C-0093)
(AD-A105746; FSU-STATISTICS-M593; TR-155-ONR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper considers the estimation of Mu relative to a convex loss function. Two classes of minimax estimators are obtained for the estimated Mu when $p > or = 3$; the first is a new result and the second is a generalization of a result of Strawderman. A proper Bayes estimator is also obtained which is shown to satisfy the conditions of the second class of minimax estimators. The paper concludes by discussing the estimation of Mu relative to another convex loss function. GRA

**N82-14866#** Princeton Univ., N. J. Dept. of Statistics.
**SOME ADVANCE THOUGHTS ON THE DATA ANALYSIS INVOLVED IN CONFIGURAL POLYSAMPLING DIRECTED TOWARD HIGH PERFORMANCE ESTIMATES**
John W. Tukey 16 Mar. 1981 20 p Prepared in cooperation with Bell Labs., Murray Hill, N.J.
(Contract DAAG29-79-C-0205)
(AD-A105906; TR-189-SER-2; ARO-16669.8-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Using configural polysampling to identify high-performance estimates proceeds in two phases: (1) estimating the best compromise to make at each configuration polysampled, and (2) choosing a generally-defined estimate whose performance comes close to that of this estimated optimum. In the first

step, shadow pricing of the criteria for the difference situations involved is helpful. In the second step, whether one uses a regression or selection-by-sectors approach, or combine both, the same shadow prices are useful. This report sketches some of the approaches to the two steps that seem natural.
Author (GRA)

**N82-14867#** Princeton Univ., N. J. Dept. of Statistics.
**KINDS OF POLYCONFIDENCE INTERVALS FOR CENTERS, AND SOME THOUGHTS ON IDENTIFICATION AND SELECTION OF CONFIDENCE PROCEDURES USING CONFIGURAL POLYSAMPLING**
John W. Tukey 16 Apr. 1981 34 p Prepared jointly with Bell Telephone Labs., Murray Hill, N.J.
(Contract DAAG29-79-C-0205)
(AD-A105907; TR-190-SER-2; ARO-16669.9-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

If we deal initially only with single situations, monoconfidence intervals can be either required only to be weak, to have proper confidence when averaged over all configurations, or to be strong, when they must have the appropriate properties conditionally for each configuration. Assuming location-and-scale invariance throughout both for situations and confidence intervals. When one considers a plot involving several situations, three kinds of polyconfidence intervals seem worth mention: (1) doubly-strong, whose properties hold separately for each combination of a situation and a configuration, (2) weak, whose properties hold on average for each situation, (3) singly strong, where the properties hold, first on average for each situation and, second, for each configuration and one situation. These notions, as well as that of balance in a conservative sense, are explored in the framework of configurations. Author (GRA)

**N82-14868#** Princeton Univ., N. J. Dept. of Statistics.
**SOME COMPUTATIONAL DETAILS OF CONFIGURAL SAMPLING METHODS**
Katherine Bell and Daryl Pregibon 30 Mar. 1981 39 p
(Contract DAAG29-79-C-0205)
(AD-A105932; TR-191-SER-2; ARO-16669.10-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

Numerical evaluation of the optimum estimate via configural sampling involves evaluation of several double integrals. These integrals represent expectations over a distribution conditioned on the observed configuration. Theoretically, any location-scale invariant definition of the configuration will suffice, though numerically, some choices are better than others. A related concern is the change-of-variables used to map the region of integration, originally the half-plane, onto a fixed region, such as the unit square. This report is of use to the reader both as a guide to the pitfalls and curiosities of the computations presently recommended. Author (GRA)

**N82-14869#** Princeton Univ., N. J. Dept. of Statistics.
**ASSESSING THE BEHAVIOR OF ROBUST ESTIMATES OF LOCATION IN SMALL SAMPLES: INTRODUCTION TO CONFIGURAL POLYSAMPLING**
Daryl Pregibon and John W. Tukey Mar. 1981 16 p refs
(Contract DAAG29-79-C-0205)
(AD-A105956; TR-182-SER-2; ARO-16669.6-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Configural polysampling offers an effective alternative to both usual Monte Carlo techniques and small sample asymptotics in studying and improving robust estimates. Attention here is restricted to location estimators that are location and scale invariant. The methods are applicable to both simple and compound sampling situations. Several possible aspects of such studies include: (a) the determination of the minimum attainable variance in each sampling situation, (b) the determination of the maximum attainable polyefficiency over several sampling situations, (c) the fine-tuning of robust estimates with the intent of increasing their polyefficiency for small n, and (d) the identification of data configurations where one can a priori expect poor performance with certain estimators. Author (GRA)

**N82-14870#** Princeton Univ., N. J. Dept. of Statistics.
**THE SECOND REPRESENTING FUNCTION FOR COMPOUND SITUATIONS**
Andrew Bruce, Daryl Pregibon, and John W. Tukey 6 Mar. 1981 16 p refs
(Contract DAAG29-79-C-0205)
(AD-A105860; TR-186-SER-2; ARO-16669.7-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper provides a convenient method of computing the low-order moments of compound situation order statistics based on higher order representing function. The explicit derivation of the second representing function is given. The one-wild-Gaussian situation is used to illustrate the method. Tables of one-wild-Gaussian order-statistic moments are displayed for selected sample sizes. GRA

**N82-14871** Tennessee Univ., Knoxville.
**A SIMPLIFIED APPROACH TO SPECTRUM ESTIMATION OF STOCHASTIC PROCESSES Ph.D. Thesis**
Mukta Lal Kar 1981 113 p
Avail: Univ. Microfilms Order No. 8123164

A simple approach to spectrum estimation for randomly sampled data was investigated. This approach is based on the Fourier series and the method of modified least squares fit to estimate the Fourier coefficients. The estimator is algebraically very simple and produces an alias free spectrum if a sufficient number of data points are available. This is true even if the mean sampling rate is less than the Nyquist rate required for spectral computation when using equi-spaced data samples. Detailed statistical and error analysis are presented for the estimator. A statistical analysis shows the estimator to be asymptotically unbiased and consistent. Also, a number of simulation experiments were conducted using both computer generated data and the data acquired in practial laboratory setups. For some cases the same data were input to other algorithms for comparison. The experimental results verify the analytic solutions in the majority of the cases. Dissert. Abstr.

**N82-14872** Oklahoma State Univ., Stillwater.
**ESTIMATION AND TESTING PROCEDURES FOR THE PARAMETERS OF THE NEGATIVE BINOMIAL DISTRIBUTION Ph.D. Thesis**
Linda Jean Willson 1981 107 p
Avail: Univ. Microfilms Order No. 8123476

The parameterization of a negative binomial distribution was studied. Where Mu is the single unknown parameter, three sequential procedures designed to estimate Mu with a desired level of precision were developed: (1) estmating Mu with a specified coefficient of variation of the estimate 'C' (2) estimating Mu within a proportion 'p' of Mu with confidence 1 - alpha, and (3) estimating Mu within 'd' units with confidence 1 - alpha. A nonparameteric, sequential procedure is developed to estimate the mean with a specific coefficient of variation of the estimate 'C'. For the two-parameter negative binomial distribution, a multistage procedure for estimating 'k' is proposed and compared, by the use of simulation, with the methods of moments and maximum likelihood estimators. The weighted regression approach to estimation and testing for a common 'k' is investigated and compared with one based on the maximum likelihood estimator and the likelihood ratio test. There are indications that the likelihood-based procedure produces more precise estimates and has greater power than the weighted regression method. Dissert. Abstr.

**N82-14873** Oklahoma State Univ., Stillwater.
**BAYESIAN FORECASTING FOR SWITCHING REGRESSION AND AUTOREGRESSIVE PROCESSES Ph.D. Thesis**
Margaret Foster Land 1981 60 p
Avail: Univ. Microfilms Order No. 8123840

Bayesian predictive density for switching regression models and for autoregressive processes was developed and investigated. For the switching regression with variance known, switch point known, and vague priors, the resulting predictive density was a normal. If the switch point was unknown, then the predictive density was a mixture of normal densities. If the variance was unknown then the predictive density involved a univariate general density if the switch point was known and a mixture of general densities if the switch point was unknown. For the linear model, all parameters unknown, and conjugate priors, the predictive density was a mixture of matrix densities. For an m-th autoregressive process with vague priors, the predictive density of the

next k future values was derived. This is the most general case. Dissert. Abstr.

**N82-14874** Tennessee Univ., Knoxville.
**INFLUENCES ON FACTORIAL ACCURACY: A MONTE CARLO INVESTIGATION Ph.D. Thesis**
Thomas Joseph Fahey, Jr. 1981 152 p
Avail: Univ. Microfilms Order No. 8123150

Twenty-seven population correlation matrices were randomly generated with specified numbers of factors, proportions of common variance, ratios of the numbers of variables to the numbers of factors. The correct numbers of factors in these 27 population correlation matrices were extracted via the principal axes factoring procedure using the true population communalities in the diagonals. The correct numbers of factors were rotated via the normalized Varimax procedure. Sixteen hundred and twenty sample correlation matrices with different ratios of observations per variable were randomly generated from the 27 population correlation matrices. Mean accuracy indices were compared via dependent sample tests for the conditions of overfactoring versus underfactoring. Results indicate that far fewer observations are needed than were previously throught, and that overfactoring is superior to underfactoring. When there are few factors, many variables, and a high proportion of common variance in the population, samples can be based on fewer observations than variables and still be highly replicable. Dissert. Abstr.

# 66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

**N82-14875#** University of Southern California, Los Angeles. Social Science Research Inst.
**VALUE TREE ANALYSIS OF ENERGY SUPPLY ALTERNATIVES**
William G. Stillwell, Detlof vonWinterfeldt, and Richard S. John Jun. 1981 41 p refs
(Contract MDA903-80-C-0194)
(AD-A105629; SSRI-81-2) Avail: NTIS HC A03/MF A01 CSCL 05/10

The use of value trees in multiattribute evaluations of energy supply alternatives was examined. A value tree relating general values and concerns to specific value relevant attributes was constructed to compare three energy options: nuclear, coal, and a combined geothermal and conservation package. Both hierarchical and non-hierarchical weighting procedures were used to rate the energy options. Several additive multiattribute models were constructed and compared with holistic rankings and ratings of the three options. Three basic findings were: (1) hierarchical weights were steeper than non-hierarchical weights; (2) groups identified by their holistic first choice showed substantial agreement in their assessment of attribute weights; (3) convergence of MAU model parameters resulted in a 'common model', consistent with holistic evaluations of the pro-conservation group, and generally inconsistent with those of the pro-nuclear group. This differential consistency between model composites and holistic evaluations is interpreted as a result of weight parameter distortions due to social desirability and a neglect to consider attribute value ranges when making weight judgments. Author

**N82-14876#** Maryland Univ., College Park. Dept. of Computer Science.
**A FUNCTIONAL TECHNIQUE FOR DECOMPOSING THE COMPLEXITY OF REQUIREMENTS ANALYSIS**
Pamela Zave Aug. 1981 25 p refs
(Contract F49620-80-C-0001; AF Proj. 2304)
(AD-A105517; AFOSR-81-0663TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper is based on an 'operational' approach to requirements specification for embedded systems, in which a requirements specification is an executable model of the proposed system interacting with its environment. The operational model is described in terms of asynchronously interacting digital processes. This paper addresses directly the question: How can such specifications for complex systems be developed? The proposed technique exploits an identification of intuitively recognizable system functions with processes in the formal specification of that system, so that its process structure can be determined during early analysis. Since the formal language supports incremental development of a specification, one process at a time, the requirements analyst can then elaborate the requirements one function at a time. Since the elaboration of each function entails quite a number of decisions, significant decomposition of complexity is achieved. The technique is illustrated within the domain of process-control systems, but its extensibility to other applications is argued. The specifications produced are good with respect to several important criteria, including modifiability and representation of performance constraints. Author (GRA)

# 67 THEORETICAL MATHEMATICS

Includes topology and number theory.

No abstracts in this category.

# 70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

No abstracts in this category.

# 71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

**N82-14877** Defence Research Information Centre, Orpington (England).
**NEAR AND FAR FIELD TECHNIQUES IN THE ANALYSIS OF NOISE GENERATION MECHANISMS. PART 1: LOCALIZATION LEVELS AND METHODS OF REPRESENTING SOURCE FIELDS, INTUITIVE INTRODUCTION TO NEAR FIELD ANTENNAE**
L. Gaudriot and M. Mercusot Sep. 1981 34 p refs Transl. into ENGLISH of 'Tech. de champ proche et lointain pour l'anal. des mecanismes de creation du bruit. Premiere partie: Niveaux de localisation et modes de representation de champs sources; introduction intuitive aux antennes de champ proche' (france)
(DRIC-T-6338; BR80434) Copyright. Avail: Issuing Activity

A technique for analyzing acoustic fields, using double layer microphones, was developed. Near field antennas were used since they permit work in an externally noisy environment to the extent that the proximity effect favors the source being studied. They can also be mounted on mobile vehicles. Wave equations were solved for vibration waves at casing surfaces and for internal stress waves in machines. Good representations of the acoustic field at the source, and of the far field, are obtained.
Author (ESA)

**N82-14878*#** Aeronautical Research Associates of Princeton, Inc., N. J.
**A STUDY OF THE VISCOUS DISSIPATION AND SURFACE LOADING ON A VIBRATING SURFACE Progress Report**
John E. Yates Washington NASA Dec. 1981 51 p refs
(Contract NAS1-16365)
(NASA-CR-3499; ARAP-451) Avail: NTIS HC A04/MF A01 CSCL 20A

The energy dissipated by viscosity at the edge of a vibrating flat plate is calculated and compared to the radiated acoustic energy. A correction to the Kirchhoff integral estimate of the noise is derived. For Helmholtz number of order unity and smaller

the dissipation can be comparable to or greater than the acoustic energy. A viscous compressible theory of the load distribution on a vibrating two dimensional body is developed. First it is shown that load calculations based on potential theory and the Newmann uniqueness condition (continuity of potential or pressure on the surface) are not in agreement with experiment or the more correct viscous theory. For a flat plate airfoil the eigensolution of potential theory is indeterminant while viscous theory yields a unique solution that has square root singularities at the edges. It is also shown that for compact surfaces the far field acoustics depend only on the magnitude of the eigensolutions of potential theoy and so will be uniquely determined by the viscous theory. It is suggested that the general viscous theory of vibrating surfaces with cross sectional geometry will lead to results in agreement with expermentally measured load distributions. Author

**N82-14879*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**EXPERIMENTAL STUDY OF NOISE REDUCTION FOR AN UNSTIFFENED CYLINDRICAL MODEL OF AN AIRPLANE FUSELAGE**

Conrad M. Willis and Edward F. Daniels Dec. 1981 36 p refs

(NASA-TP-1964; L-14878) Avail: NTIS HC A03/MF A01 CSCL 20A

Noise reduction measurements were made for a simplified model of an airplane fuselage consisting of an unstiffened aluminum cylinder 0.5 m in diameter by 1.2 m long with a 1.6-mm-thick wall. Noise reduction was first measured with a reverberant field pink-noise load on the cylinder exterior. Next, noise reduction was measured by using a propeller to provide a more realistic noise load on the cylinder. Structural resonance frequencies and acoustic reverberation times for the cylinder interior volume were also measured. Comparison of data from the relatively simple test using reverberant-field noise with data from the more complex propeller-noise tests indicates some similarity in both the overall noise reduction and the spectral distribution. However, all of the test parameters investigated (propeller speed, blade pitch, and tip clearance) had some effect on the noise-reduction spectra. Thus, the amount of noise reduction achieved appears to be somewhat dependent upon the spectral and spatial characteristics of the flight conditions. Information is also presented on cyclinder resonance frequencies, damping, and characteristics of propeller-noise loads. Author

**N82-14880*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**PREDICTION OF FLYOVER JET NOISE SPECTRA FROM STATIC TESTS**

Ulf Michel and Alfons Michalke (Technische Univ., Berlin) Dec. 1981 27 p refs Presented at the 100th Meeting of the Acoust. Soc. of Am., Los Angeles, Nov. 1980

(NASA-TM-83219; L-14953) Avail: NTIS HC A03/MF A01 CSCL 20A

A scaling law is derived for predicting the flyover noise spectra of a single-stream shock-free circular jet from static experiments. The theory is based on the Lighthill approach to jet noise. Density terms are retained to include the effects of jet heating. The influence of flight on the turbulent flow field is considered by an experimentally supported similarity assumption. The resulting scaling laws for the difference between one-third-octave spectra and the overall sound pressure level compare very well with flyover experiments with a jet engine and with wind tunnel experiments with a heated model jet.

Author

**N82-14881*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**MODE PROPAGATION IN NONUNIFORM CIRCULAR DUCTS WITH POTENTIAL FLOW**

Y. C. Cho and K. U. Ingard (MIT) 1982 15 p refs Presented at the 20th Aerospace Sci. Conf., Orlando, Fla., 11-14 Jan. 1982

(NASA-TM-82776; E-1086; AIAA-Paper-82-0122) Avail: NTIS HC A02/MF A01 CSCL 20A

A previously reported closed form solution is expanded to determine effects of isentropic mean flow on mode propagation in a slowly converging-diverging duct, a circular cosh duct. On the assumption of uniform steady fluid density, the mean flow increases the power transmission coefficient. The increase is directly related to the increase of the cutoff ratio at the duct throat. With the negligible transverse gradients of the steady fluid variables, the conversion from one mode to another is negligible, and the power transmission coefficient remains unchanged with the mean flow direction reversed. With a proper choice of frequency parameter, many different modes can be made subject to a single value of the power transmission loss. A systematic method to include the effects of the gradients of the steady fluid variables is also described. B.W.

**N82-14882#** SACLANT ASW Research Center, La Spezia (Italy).

**VARIABILITY OF ACOUSTIC TRANSMISSIONS IN A SHALLOW WATER AREA**

Erik Sevaldsen 1 May 1981 52 p refs

(AD-A103278; SACLANTCEN-SR-46) Avail: NTIS HC A04/MF A01 CSCL 20/1

A series of experiments on the variability of acoustic transmissions in a shallow water area is described. The variables considered are time (short period and seasons), frequency of transmission (1 to 6 kHz), and space (location and depth of source, depth of receiver). The variables are studied mainly in terms of transmission loss fluctuations and spreading in frequency and delay of phase coherent pulse signals. Short period transmission loss fluctuations were found to be within + or - dB of the mean, with some few significant exceptions in summer. Delay spreading (3 dB) was found to be rather small, mostly near 5 ms, because there was usually only one strong arrival/arrival cluster. The measured frequency spreading is classified in two groups, one showing very little spreading, delta f epsilon (0.05 to 0.1) Hz, the other showing much more spread, delta f > 1 Hz. This is interpreted as the result of internal wave action under the existing sound propagation conditions. Author

**N82-14883#** Naval Postgraduate School, Monterey, Calif.

**ON THE DESIGN OF AN ACOUSTICALLY ISOLATING BUBBLE SCREEN FOR THE CARR INLET ACOUSTIC RANGE M.S. Thesis**

Kenneth William Marr Jun. 1981 93 p refs

(AD-A105830) Avail: NTIS HC A05/MF A01 CSCL 20/1

The theoretical acoustic behavior of an underwater bubble screen is examined using Rayleigh reflection theory. A microcomputer model simulates the acoustic impedance mismatch at the interfaces of an ideal, bubble screen. A sensitivity analysis indicates that the angle of incidence of sound energy and the speed of sound in the layer are the most important screen properties for predicting the insulating capability of a bubble screen. Frequencies for which the screen thickness is an integral number of half wavelengths, the interference results in a reduced reflection coefficient and a corresponding increase in transmission through the screen. For a broad band spectrum wide enough to cover a number of such frequencies, the attenuation to be expected exceeds 10 dB only over about 90 percent of the spectrum.

Author

**N82-14884#** Hydroacoustics, Inc., Rochester, N.Y.

**DESIGN STUDY OF HYDROACOUSTIC IMPULSE SOURCE FOR DEEP TOWING, PHASE 2 Final Report**

21 Sep. 1981 29 p

(Contract N00014-80-C-0357)

(AD-A106066; HA-115-81) Avail: NTIS HC A03/MF A01 CSCL 17/1

The results of the second phase of a design study of the DEEPSHOCK impulse sound source for use in a deepp-towed seismic profiling system are summarized. This phase of the program focused on the oil-backed impulse source identified in the first phase of the source development program. Included herein are a description of the source operation, a summary of the computer model and design interation task, a description of the source evolution, and a detailed description of the source with layout drawings and materials list. Author

**N82-14885#** Naval Ocean Systems Center, San Diego, Calif.

**WAVE STRUCTURE DETECTION THROUGH TWO-DIMENSIONAL FILTERING Final Report, 1 Jul. - 30 Sep. 1980**

C. Mirabile 10 Jan. 1981 26 p
(ZF11111003)
(AD-A105554; NOSC/TR-694) Avail: NTIS
HC A03/MF A01 CSCL 20/1

This report contains an analysis of the potential of using a noncoherent two dimensional filter technique to extract a ridge-like signal from a two dimensional surface. The two dimensional surface consists of the signal plus white Gaussian noise. It is demonstrated that the technique shows promise both in visual ridge detection and in automatic energy ratio detection. It is suggested that a more elegant form of the filter used here (complex coefficient) be used to further enhance the ridge-like signal structure. Author (GRA)

**N82-14886#** Naval Postgraduate School, Monterey, Calif.
**THE EFFECT OF SCATTERING AND ABSORPTION ON NOISE FROM A CAVITATING NOISE SOURCE IN THE SUBSURFACE OCEAN LAYER M.S. Thesis**
Yngvar Dag Tronstad Jun. 1981 177 p refs
(AD-A105758) Avail: NTIS HC A09/MF A01 CSCL 20/1

When investigating the detection performance of a passive homing torpedo used against shallow draft surface ships, certain environmental factors such as the rough sea surface and the bubble dominated inhomogeneous layer near the sea surface have to be considered. This thesis attempts to gain some insight into the behavior of a homing torpedo system during its critical attack phase, as well as getting some indications of the relative importance of the scattering mechanisms and the induced tactical limitations. An idealized propagation model was used as reference of comparison. For a given sea state and target speed the results stress the importance of low operating frequency as well as a high maximum turn rate. They also point to the importance of having a search depth below the bubble-dominated subsurface layer, and a variable speed capability during the torpedo's attack phase. Author (GRA)

**N82-14887#** Naval Postgraduate School, Monterey, Calif.
**ACOUSTOOPTICAL SPECTRUM ANALYSIS MODELING M.S. Thesis, 1 Oct. 1980 - 30 Jun. 1981**
Michael James Carmody Jun. 1981 115 p refs
(AD-A105866; NPS-62-18-033) Avail: NTIS
HC A06/MF A01 CSCL 20/1

A summary of Bragg deflection theory and various approaches to direct detection acoustooptic spectrum analysis (AOSA) modeling is presented. A suitable model is chosen and extended to include the effects of diffraction efficiency, transducer efficiency, irradiance profiles of incident laser illumination, aperture size of the Bragg cell, and the acoustic attenuation experienced by the acoustic wavetrain generated by the input r-f signal. A FORTRAN program is developed to model the AOSA and predict the output image plane intensity profiles. A second version of the program includes a time variable permitting dynamic simulation of the system response. Author (GRA)

**N82-14888#** Catholic Univ. of America, Washington, D.C. Dept. of Physics.
**INTERIOR AND EXTERIOR RESONANCES IN ACOUSTIC SCATTERING. 1: SPHERICAL TARGETS. 2: TARGETS OF ARBITRARY SHAPE (T-MATRIX APPROACH) Interim Report, 1 Feb. - 30 Sep. 1981**
G. C. Gaunaurd, E. Tanglis, H. Ueberall, and D. Brill (Naval Academy) 14 Sep. 1981 65 p refs Prepared in cooperation with Naval Surface Weapons Center, White Oak, Md.
(Contract N00014-76-C-0430; NR Proj. 384-914; RR011008001)
(AD-A105534) Avail: NTIS HC A04/MF A01 CSCL 20/1

Spherical targets. In acoustic scattering from elastic objects, resonances features appear in the returned echo at frequencies where the objects eigenfrequencies are located, which are explained by the excitation of interior creeping waves. Corresponding resonance terms may be split off from the total scattering amplitude, leaving behind an apparently nonresonant background amplitude. This is demonstrated here for scatterers of spherical geometry, and in the following companion paper also for scatterers or arbitrary geometry, using the T-matrix approach. For the case of near-impenetrable spheres, it is subsequently shown that the background amplitude can be split further into specularly reflected contributions, plus highly attenuated resonance terms which are explained by the excitation of exterior (Franz-type) creeping waves. The singularity structure of the scattering function is shown mathematically, using the R-matrix approach of Nuclear scattering theory, as that of a meromorphic function without any additional 'entire function' (as had been postulated by the Singularity Expansion Method). Author (GRA)

**N82-14889#** Pennsylvania State Univ., University Park. Applied Research Lab.
**A SCATTERING FUNCTION APPROACH TO UNDERWATER ACOUSTIC DETECTION AND SIGNAL DESIGN Ph.D. Thesis**
Lawrence J. Ziomek 7 Oct. 1981 300 p refs
(Contract N00024-79-C-6043)
(AD-A105593; ARL/PSU/TM-81-144) Avail: NTIS
HC A13/MF A01 CSCL 20/1

In this dissertation, the design of transmit and processing waveforms is used to maximize the signal-to-interference ratio (SIR) to improve the detectability of a doubly spread target return in the presence of volume and/or surface reverberation plus white Gaussian noise. The SIR is dependent upon target and reverberation scattering functions and the cross-ambiguity function of the transmit and processing waveforms. Volume reverberation, target, and surface reverberation scattering functions are derived. Volume reverberation is modelled as the spatially uncorrelated scattered field from randomly distributed point scatterers in deterministic plus random translational motion. A single scattering approximation is used and general, frequency dependent transmit and receive arrays are included in all derivations. The doubly spread target is modelled as a linear array of discrete highlights in deterministic translational motion. A target scattering function is obtained from the general bistatic volume reverberation scattering function by appropriately specifying the volume density function of the discrete point scatterers for a monostatic geometry. GRA

**N82-14890#** Naval Underwater Systems Center, New London, Conn. Surface Ship Sonar Dept.
**THE EFFECT OF THE MID-ATLANTIC RIDGE ON LONG RANGE SOUND PROPAGATION**
R. F. LaPlante, P. D. Koenigs, and D. G. Browning 1 Oct. 1981 16 p Presented at the 101st Meeting of the Acoust. Soc. of Am., Ottawa, 20 May 1981
(AD-A105747; NUSC-TD-6555) Avail: NTIS
HC A02/MF A01 CSCL 20/1

This document contains the oral and visual presentation given at the 101st Meeting of the Acoustical Society of America, 20 May 1981, Ottawa, Canada. Previous long range acoustic experiments show that the Mid-Atlantic Ridge, a major topographic feature rising to the deep sound channel axis can have a significant effect on SOFAR propagation. (R. J. Urick, J. Acoust. Soc. Am. 35(9), 1413, 1963.) In order to quantify this effect, data have been analyzed from a recent SOFAR experiment that deployed SUS charges during several transits across the Ridge. The signals were received on a hydrophone located near Bermuda, a distance of approximately 2500 km. These results are comapared with data from Atlantic seamounts of similar height and ridges in other oceans. (K. M. Guthrie, J. Acoust. Soc. Am., 68(S1), S52(A), 1980.) The enhancement or shadowing of SOFAR propagation is presented as a function of source depth and frequency for various geometries. Author (GRA)

**N82-14891#** Naval Underwater Systems Center, New London, Conn. Surface Ship Sonar Dept.
**MEASUREMENTS OF THE LOW-FREQUENCY WIND-GENERATED AMBIENT NOISE IN THE DEEP OCEAN**
R. W. Bannister, R. N. Denham, K. M. Guthrie, and D. G. Browning 1 Oct. 1981 15 p Presented at the 101st Meeting of the Acoust. Soc. Am., Ottawa, Canada, 21 May 1981
(AD-A105748; NUSC-TD-6565) Avail: NTIS
HC A02/MF A01 CSCL 20/1

This document presents the oral and visual presentation entitled 'Measurements of the Low-Frequency Wind-Generated Ambient Noise in the Deep Ocean,' presented at the 101st Meeting of the Acoustical Society of America, 21 May 1981, in Ottawa, Ontario, Canada. Southern Hemisphere oceans provide unique conditions for the measurements of low-frequency wind-generated ambient noise due to their relatively

low shipping densities. Results (10-500 Hz) for a single location in the South Fiji Basin supported the two principal noise generation mechanisms that have been suggested: turbulence, bubbles and spray. For a given local wind speed, higher noise levels were observed than have been reported for the North Atlantic Ocean. This paper is an analysis of wind-generated noise data from additional sites throughout the Tasman Sea-Fiji Basin region. Variation in measured level is compared to wind speed, sea state, and propagation conditions. It appears that local wind speed is not an absolute indicator of wind generated ambient noise level. GRA

**N82-14892#** Naval Ship Research and Development Center, Bethesda, Md. Central Instrumentation Dept.
**A DATA REDUCTION PROCEDURE FOR CAVITATION NOISE FROM AN OSCILLATING HYDROFOIL**
Robert D. Pierce Jul. 1981 40 p refs
(AD-A105719; DTNSRDC/CID-81/2) Avail: NTIS HC A03/MF A01 CSCL 20/1

An improved computerized technique has been used to analyze nonstationary cavitation noise from an oscillating hydrofoil. Combined analog and digital signal processing procedures were developed that use ensemble averaging techniques to quantify the average sound pressure variance as a function of the foil's angle of attack. The averages provide a quantitative basis for comparing cavitation noise produced by this hydrofoil under a finite spectrum of specific test conditions. Author (GRA)

**N82-14893** Purdue Univ., Lafayette, Ind.
**ULTRASOUND CHARACTERIZATION OF DISTURBED FLOW PATTERNS Ph.D. Thesis**
Lionel Joseph DLuna 1981 348 p
Avail: Univ. Microfilms Order No. 8123639

Techniques to observe flow patterns using pulsed RF Doppler ultrasound were investigated and experimental measurements on disturbed vortex shedding flows carried out. Vortex structure and the possible characteristics that are manifest in the Doppler signals were analyzed. It was found that the best geometry is to observe the flow pattern with the ultrasound beam normal to the flow direction. A realistic acoustic scattering model was developed from which the Doppler signals pertaining to a known Karman vortex velocity field are simulated. Experimental measurements were made on steady channel flows and the ability of the ultrasonic techniques to detect isolated vortices was determined. In vitro bio-fluid flows were studied under steady and pulsatile conditions. Stenosis sections of fifty percent and seventy-five percent occlusion were introduced into a tube flow and the flow patterns distal to the stenoses are measured. Dissert. Abstr.

# 72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

**N82-14894** Temple Univ., Philadelphia, Pa.
**NEUTRINO, MAXWELL AND SCALAR FIELDS IN CYLINDRICAL AND SPHERICAL RELATIVISTIC SPACES Ph.D. Thesis**
David Frank Cattell 1981 226 p
Avail: Univ. Microfilms Order No. 8124556

The quantum-mechanical theory of neutrino, Maxwell and zero-mass scalar fields treated as test fields in two different fixed background spacetimes representing respectively spatial cylindrical and spherical symmetries are discussed. The metrics for these spacetimes are exact solutions of the Einstein gravitational field equations. In the first case the background metrics is that of the static, cylindrically symmetric magnetic or plasm universe whose theory has been given by Melvin. In the second case the background metric is that of the Schwarzschild geometry external to an isolated spherically-symmetric source of gravity. An analogy between the plasm universe and a dielectric medium (or wave guide) is made for the case of electromagnetic waves (with m = o) traveling at an angle with respect to the plasm universe z-axis; these waves are shown to be transverse in the radiation zone. Dissert. Abstr.

**N82-14895#** Rochester Univ., N. Y. Dept. of Chemistry.
**GORDON RESEARCH CONFERENCE ON MOLECULAR ENERGY TRANSFER Final Technical Report**
Thomas F. George Jul. 1981 13 p Conf. held at Wolfeboro, N.H., 29 Jun. - 3 Jul., 1981; sponsored by Rhode Island Univ.
(Grant AF-AFOSR-0173-81; AF Proj. 2303)
(AD-A105441, AFOSR-81-0640TR) Avail: NTIS HC A02/MF A01 CSCL 20/8

The 1981 Gordon Research Conference on Molecular Energy Transfer brought together an international group of both experimentalists and theorists working in a wide variety of topics in the gaseous, liquid and solid phases. State-of-the-art techniques were presented and analyzed, and the Conference was beneficial to all participants. Author (GRA)

**N82-14896#** Naval Postgraduate School, Monterey, Calif.
**CERENKOV RADIATION PRODUCED BY 100 MeV ELECTRONS M.S. Thesis**
David Earl McLaughlin Jun. 1981 49 p refs
(AD-A105864) Avail: NTIS HC A03/MF A01 CSCL 20/8

It is proposed that electromagnetic radiation of a specified frequency can be produced as a result of stimulated Cerenkov radiation in a dielectric resonator excited by a superluminal electron beam. The frequency generated is a function of three physical parameters. They are the electron energy, the thickness of the dielectric resonator and its index of refraction. This work provides a theoretical derivation for predicting the frequency of stimulated Cerenkov radiation in a dielectric slab. The first experimental results using extremely relativistic electrons are reported, and the problems encountered are outlined with some suggestions for improvements. The results of this validation show that the observed frequency differs from the predicted frequency by less than 1.5%. Incidental to the conduct of this experiment, ordinary Cerenkov radiation in the usual cone was observed in air at microwave frequencies. A possible application of the stimulated Cerenkov process as an electron beam monitor is briefly discussed. Author (GRA)

**N82-14897#** New York Univ., N. Y. Dept. of Physics.
**THEORETICAL STUDIES RELATING TO THE INTERACTION OF RADIATION WITH MATTER: ATOMIC COLLISION PROCESSES OCCURRING IN THE PRESENCE OF RADIATION FIELDS Annual Report, 1 Aug. 1980 - 31 Jul. 1981**
P. R. Berman 15 Sep. 1981 147 p refs
(Contract N00014-77-C-0553)
(AD-A105789; AR-4) Avail: NTIS HC A07/MF A01 CSCL 20/8

Work is reported in the areas of: Two-Level Atom and Radiation Pulse; Effects of Collisions on Atomic Coherences; Effects of Collisions on Zeeman Coherences; Collision Effects in Degenerate-Four-Wave-Mixing; and Dressed-Atom Picture in Laser Spectroscopy. Author (GRA)

**N82-14898#** California Univ., Livermore. Lawrence Livermore Lab.
**SIMPLE MODEL OF BEAM TRANSPORT IN LOW-PRESSURE ION-FOCUSED REGIMES**
R. J. Briggs 1 Sep. 1981 15 p refs
(Contracts W-7405-eng-48; N60921-81-LT-W0009; N60921-81-LT-W0026; DARPA Order 3718)
(DE82-000242; UCID-19187) Avail: NTIS HC A02/MF A01

A simple model of self-focused beam transport at very low gas pressures is presented. Fractional electric neutralization is incomplete and secondary electrons are expelled from the beam region. DOE

**N82-14899#** Georgia Inst. of Tech., Atlanta. School of Physics.
**NUCLEAR STRUCTURE FROM RADIOACTIVE DECAY Annual Progress Report**
J. L. Wood 30 Sep. 1981 13 p refs
(Contract DE-AS05-80ER-10599)
(DE82-000423; DOE/ER-10599/T1) Avail: NTIS HC A02/MF A01

The neutron-deficient nuclei around the Z = 82 shell closure is studied, with special emphasis on the levels of the odd-mass Pt, Au, Hg and Tl isotopes. The low-energy structural features of sequences of isotopes (and isotones) were examined

over many adjacent mass numbers. This has a two-fold purpose. First, it enables one to build up a very complete picture of nuclear structure that connects the regions of stable nuclei (where, e.g., transfer reactions and Coulomb excitation permit the measurement of detailed spectroscopic properties) with regions far from stability, where detailed spectroscopic information is very limited. Second, it provides a map of the excitation degrees of freedom as a function of the changing proton and neutron number over broad mass regions. DOE

**N82-14900#** Teknekron, Inc., McLean, Va.
**ENVIRONMENTAL READINESS DOCUMENT. ADVANCED ISOTOPE SEPARATION PROGRAM**
Aug. 1981 56 p refs
(Contract DE-AC01-79EV-10292)
(DE81-029952; DOE/EP-0029) Avail: NTIS HC A04/MF A01

The uncertainties to be resolved through research development and those that constitute a limit on the confidence that can be placed in the conclusions are addressed. The conclusions are presented, giving the probabilities of an adverse finding resulting from further environmental research. The impacts and concerns are treated without reference to specific sites or location. The technology from which the environmental concerns emerge is described. Drawn from the technology program office and the Environmental Development plan for the Advanced Isotope Separation Program (AIS) is provided. The likelihood of adverse findings concerning the environmental acceptability of the technology, the problems and uncertainties stemming from current or anticipated environmental regulation, and the environmental and control considerations is examined. On this basis, an assessment is offered of the existing or potential barriers to commercialization. Environmental control research is discussed and associated costs are addressed. The impact of environmental-related costs on the cost of enriching uranium by the AIS techniques is also addressed. Current and possible new standards related to this technology are identified. Estimates of relative chemical hazards are provided. The feed and product associated with the current nuclear fuel cycle facilities and the changes that may be required by introduction of AIS into the enrichment enterprise are characterized. A glossary is included. DOE

**N82-14901#** Battelle Pacific Northwest Labs., Richland, Wash.
**EFFECT OF ORGANIC COMPLEXANTS ON THE MOBILITY OF LOW-LEVEL WASTE RADIONUCLIDES IN SOILS: STATUS REPORT**
J. L. Swanson Sep. 1981 33 p refs
(Contract DE-AC06-76RL-01830)
(DE81-030409; PNL-3927) Avail: NTIS HC A03/MF A01

The effects of some organic complexants on the sorption by soil of some elements typical of those present in low-level wastes are evaluated and procedures are developed to efficiently obtain valid sorption data. Data were obtained with Hanford soil and the elements europium, nickel, cobalt, cesium, and strontium. Complexants studied include: ethylenediaminetetraacetic acid (EDTA), diethylenetriaminepentaacetic acid (DTPA), and humic acid. The sorption of cesium and strontium was found to be affected very little by EDTA or DTPA. These complexants were found to greatly reduce the sorption of europium, nickel, or cobalt by the soil. The Eu/EDTA system was found to be well behaved, and the effect of the complexant on the sorption by soil was quantified. With nickel and cobalt kinetic problems were encountered, and the effects of complexants on the sorption by soil have not yet been quantified. DOE

**N82-14902#** Sandia Labs., Albuquerque, N. Mex.
**TEMPERATURE DEPENDENCE OF H SATURATION AND ISOTOPE EXCHANGE**
B. L. Doyle, W. R. Wampler, and D. K. Brice 1981 5 p refs Presented at the Fusion Reactor Mater. Meeting, Seattle, 9 Aug. 1981
(DE-AC04-76DP-00789)
(DE81-026633; SAND-81-0291C; CONF-810831-34) Avail: NTIS HC A02/MF A01

The retention, release, and isotope exchange of ion implanted hydrogen and deuterium in carbon and TiC were investigated as a function of temperature. The implantations were performed both at room and elevated temperatures. In addition, samples implanted at room temperature were annealed isochronally to measure the thermal release of hydrogen. The results of the experiments indicate that both the saturation and isotopic exchange properties of hydrogen have significant temperature dependence. DOE

**N82-14903#** Brookhaven National Lab., Upton, N. Y. Dept. of Chemistry.
**ELECTRON TRANSFER IN WEAKLY INTERACTING SYSTEMS**
Norman Sutin and Bruce S. Brunschwig 1981 33 p refs Presented at Symp. on Inorganic Reaction Mechanisms, Detroit, 10 Jun. 1981
(DE81-026134; BNL-29895; CONF-8106139-3) Avail: NTIS HC A03/MF A01

A recently proposed semiclassical model, in which an electronic transmission coefficient and a nuclear tunneling factor are introduced as corrections to the classical activated-complex expression, is described. The nuclear tunneling corrections are shown to be important only at low temperatures or when the electron transfer is very exothermic. By contrast, corrections for nonadiabaticity may be significant for most outer-sphere reactions of metal complexes. The rate constants for electron exchange reactions predicted by the semiclassical model are in very good agreement with the observed values. The implications of the model for optically-induced electron transfer in mixed-valence systems are noted. DOE

**N82-14904** Stanford Univ., Calif.
**DESIGN AND PERFORMANCE OF TIME-FREQUENCY-CODED SIGNALS FOR SPREAD-SPECTRUM SYSTEMS**
**Ph.D. Thesis**
Khiem Van Cai 1981 222 p
Avail: Univ. Microfilms Order No. 8123615

A fundamental problem in multiple-access communication systems employing spread-spectrum signals is that of designing a large set of signals that have uniformly small crosscorrelation properties. The uniformly small crosscorrelation property is necessary to permit the signals to be detected with matched filters and a threshold operation. The size of the signal set should be as large as possible in order that the greatest number of potential users, each having a uniquely assigned signal, can be accommodated by the system. Dissert. Abstr.

# 73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

**N82-14905#** Oak Ridge National Lab., Tenn. Engineering Physics Div.
**REPRESENTATION OF THE NEUTRON CROSS SECTIONS OF SEVERAL FERTILE AND FISSILE NUCLEI IN THE RESPONSE REGIONS**
G. deSaussure and R. B. Perez Sep. 1981 42 p refs
(Contract W-7405-eng-26)
(DE82-000504; ORNL/TM-7945; ENDF-312) Avail: NTIS HC A03/MF A01

Several problems related to the measurement, analysis and evaluation of the neutron cross sections of the main fertile and fissile nuclides in the resonance region are reviewed. In particular, the ENDF/B-V representation of these cross sections are discussed. In recent years little progress has been made in improving knowledge of the resolved resonance parameters of the fertile nuclei. It is suggested that this absence of progress is due to a lack of adequate methodologies to deal with the systematic errors arising from uncertainties in the analysis of the measurements. The ENDF/B treatment of the unresolved resonance is discussed, and the validation of the unresolved resonance range evaluations with appropriate transmission and self-indication measurements is recommended. DOE

**N82-14906#** California Univ., Livermore. Lawrence Livermore Lab.
**ATA INJECTOR-GUN CALCULATIONS**
A. C. Paul 3 Aug. 1981 54 p refs
(Contracts W-7405-eng-48; N60921-81-LT-W0009; N60921-81-LT-W0026; DARPA Order 3718)
(DE82-001149; UCID-19197) Avail: NTIS HC A04/MF A01

ATA is a pulsed, 50 ns 10 KA, 50 MeV linear induction electron accelerator at LLNL. The ETA could be used as an injector for ATA. However the possibility of building a new injector gun for ATA, raised the question as to what changes from the ETA gun in electrode dimensions or potentials, if any, should be considered. In this report the EBQ code results for the four electrode configurations are reviewed and an attempt is made to determine the geometrical scaling laws appropriate to these ETA type gun geometries. Comparison of these scaling laws will be made to ETA operation. The characteristic operating curves for these geometries will also be presented and the effect of washer position determined. It will be shown that emittance growth will impose a limitation on beam current for a given anode potential before the virtual cathode limit is reached. DOE

**N82-14907#** Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
**CHARACTERIZATION OF MATERIALS FOR WASTE-CANISTER COMPATIBILITY STUDIES**
H. McCoy and J. E. Mack Oct. 1981 33 p refs
(Contract W-7405-eng-26)
(DE82-000902; ORNL/TM-7917) Avail: NTIS HC A03/MF A01

Sample materials of severn radioactive waste forms and fifteen canister materials were procured for compatability tests. A test capsule was designed for the tests in which disks of a single waste form were contacted with duplicate samples of canister materials under modest spring compression. The program involved long-term tests at 100 C and 300 C temperatures typical of storage, and tests at 800 C to simulate temperatures that might occur as a result of a fire in a transportation accident. DOE

**N82-14908#** Battelle Pacific Northwest Labs., Richland, Wash.
**APPLICATION OF A SITE-BINDING, ELECTRICAL, DOUBLE-LAYER MODEL TO NUCLEAR WASTE DISPOSAL**
J. F. Relyea and R. J. Silva Sep. 1981 28 p refs
(Contract DE-AC06-76RL-01830)
(DE81-030231; PNL-3898) Avail: NTIS HC A03/MF A01

A site-binding, electrical, double-layer adsorption model was applied to adsorption of Cs for both a montmorillonite clay and powdered SiO2. Agreement between experimental and predicted results indicates that Cs(+) is adsorbed by a simple cation-exchange mechanism. Further application of a combination equilibrium thermodynamic model and site-binding, electrical, double-layer adsorption model was made to predict the behavior of U(VI) in solutions contacting either the montmorillonite clay or powdered SIO2. Given the existing information about the probable U solution species, it was possible to determine that UO2(+2) is most likely adsorbed by cation-exchange at pH 5. At higher values (pH 7 and 9), it was shown that UO2(OH)2(0) is probably the most strongly adsorbed U solution species. It was also found that high NaCl solution concentrations at higher pH values lowered U concentrations. DOE

**N82-14909#** Battelle Pacific Northwest Labs., Richland, Wash.
**BEHAVIOR OF RADIOACTIVE IODINE AND TECHNETIUM IN THE SPRAY CALCINATION OF HIGH-LEVEL WASTE**
C. A. Knox and R. K. Farnsworth Aug. 1981 22 p refs
(Contract DE-AC06-76RL-01830)
(DE81-028405; PNL-3741) Avail: NTIS HC A02/MF A01

The Remote Laboratory-Scale Waste Treatment Facility (RLSWTF) was designed and built as a part of the High-Level Waste Immobilization Program (now the High-Level Waste Process Development Program) at the Pacific Northwest Laboratory. In facility, installed in a radiochemical cell, is described in which installed in a radiochemical cell is described in which small volumes of radioactive liquid wastes can be solidified, the process off gas can be analyzed, and the methods for decontaminating this off gas can be tested. During the spray calcination of commercial high-level liquid waste spiked with Tc-99 and I-131 and 31 wt% loss of I-131 past the sintered-metal filters. These filters and venturi scrubber were very efficient in removing particulates and Tc-99 from the the off-gas stream. Liquid scrubbers were not efficient in removing I-131 as 25% of the total lost went to the building off-gas system. Therefore, solid adsorbents are needed to remove iodine. For all future operations where iodine is present, a silver zeolite adsorber is to be used. DOE

**N82-14910#** Battelle Pacific Northwest Labs., Richland, Wash.
**COMPARISON OF POTENTIAL RADIOLOGICAL CONSEQUENCES FROM A SPENT-FUEL REPOSITORY VERSUS NATURAL-URANIUM DEPOSITS**
M. O. Cloninger and O. J. Wick Dec. 1980 15 p refs Presented at the ANS Waste Management Conf., Tucson, Ariz., 23-26 Feb. 1981
(Contract DE-AC06-76RL-01830)
(DE81-028232; PNL-SA-8881; CONF-810217-19) Avail: NTIS HC A02/MF A01

The long term hazard from spent fuel in a geologic repository is found to be comparable to that of a large ore deposit, although the specific nuclide concentration in an individual fuel element is not duplicated in nature. A repository constructed within reasonable constraints present no greater hazard than a large ore deposit. The natural hazard due to some observed radioactive releases to the biosphere in the United States far exceeds any that could reasonably be expected from a spent-fuel repository. Use natural ore deposits as a basis for criteria for nuclear waste repositories is so variable that it does not allow a specific criterion to be stated in absolute terms. If the naturally radioactive environment is to be used as a criterion for repositories, the radiological quality of the environment in the immediate region of a specific repository, and an acceptable potential increase in that radiological content due to the existence of the repository should be considered. M.D.K.

**N82-14911#** Sandia Labs., Albuquerque, N. Mex. Plasma Theory Div.
**ELECTROMAGNETIC EFFECTS ON THE FORMATION OF POTENTIAL WELLS FOR ION ACCELERATION**
J. W. Poukey Jul. 1981 18 p refs
(Contract DE-AC04-76DP-00789)
(DE81-028240; SAND-81-1637) Avail: NTIS HC A02/MF A01

The new 2-D electromagnetic particle code MAGIC was used to study the formation of potential wells with relativistic electron beams injected through a foil into a conducting cavity. The basic results are shown to agree with quasi-static work published 5 to 10 years ago. DOE

**N82-14912#** Oak Ridge National Lab., Tenn.
**DESIGN STUDY FOR SUPERCONDUCTING MAIN FIELD COILS FOR THE OAK RIDGE ISOCHRONOUS CYCLOTRON**
S. W. Schwenterly, P. S. Litherland, J. K. Ballou, R. L. Brown, W. A. Fietz, W. H. Gray, E. D. Hudson, R. S. Lord, M. S. Lubell, J. A. Martin et al 1981 8 p refs Presented at the 1981 Cryogenic Eng. Conf., San Diego, Calif., 10 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028066; CONF-810835-9) Avail: NTIS HC A02/MF A01

A design study to describe the feasibility of replacing the existing ORIC coils with superconducting magnets is described. The design is quite conservative, requires no usual technology, and should result in a coil system with good reliability and durability. The operating regime of ORIC will be considerably extended, and running costs should be reduced. A proposal to continue with detailed design and coil fabrication is currently under review and has been submitted to the Nuclear Science Advisory Committee. DOE

## 74 OPTICS

Includes light phenomena.

**N82-14913** Defence Research Information Centre, Orpington (England).

**THIRD ORDER ABERRATIONS OF CLASSICAL MIRROR LENSES WITH SPHERICAL SURFACES**

Ludvik Canzek Aug. 1981 17 p refs Transl. into ENGLISH from Optik, West Germany, v. 57, no. 1, 1980 p 1-8
(DRIC-T-6359; BR80027) Copyright. Avail: Issuing Activity

The Seidel analysis of third order aberrations is proposed as an aid for correcting geometric aberrations. The Seidel aberrations are shown to be functions of the central obstruction only where the focal point coincides with the apex of the primary mirror. Catadioptric lenses are regarded, for correction purposes, as classical mirror systems supplemented with lenses. This is illustrated by considering Newton, Cassegrain, and Swarzschild systems. The Swarzschild combination provides an exceptional means of correction and exhibits minimal zonal aberration.

Author (ESA)

**N82-14914#** Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Technical Physics.

**STUDIES OF RESONANCE-LIGHT PRESSURE Ph.D. Thesis**

Juha Javanainen 1980 23 p refs
(ISBN-951-45-2131-5) Avail: NTIS HC A02/MF A01

A Fokker-Planck equation for the projection of the atomic velocity distribution onto the wave vector direction of a plane wave of light is presented. The formula is also applied to the cooling of gases. The isotope separation by selective deflection of the desired isotope out of an atomic beam is investigated. The laser cooling of an ion trapped in a parabolic potential well, and the three dimensional problem of a trapped ion with an arbitrary direction of the incident laser beam are examined. The center of mass motion of the ion is analyzed in the representation of the harmonic oscillator eigenstates. The rate equations presuppose that either the intensity is low, or that the frequency of the mechanical oscillator exceeds the power broadened linewidth of the transition. S.L.

**N82-14915#** Centre National de la Recherche Scientifique, Marseilles (France). Lab. d'Astronomie Spatiale.

**FOC F/96 POLARIZERS**

M. Saisse 17 Sep. 1980 103 p refs
Avail: NTIS HC A06/MF A01

Vacuum ultraviolet optical properties are studied. A MgF2 prism, useful as a polarizer or analyzer, is described. Applications of anomalous dispersion effects at short wavelengths for sapphire and MgF2 are discussed in relation to optical pumping and chromatography. For individual titles, see N82-14916 through N82-14917.

**N82-14916*#** Arizona Univ., Tucson. Lunar and Planetary Lab.

**A POLARIZER FOR VACUUM ULTRAVIOLET**

D. L. Steinmetz, W. G. Phillips, M. Wirick, and F. F. Forbes *In* CNES FOC F/96 Polarizers 17 Sep. 1980 4 p refs Repr. from Appl. Opt., v. 6, no. 6, Jun. 1967 p 1001-1004 Revised Sponsored by NASA (For primary document see N82-14915 05-74)
Avail: NTIS HC A06/MF A01 CSCL 20F

An MgF2 double Rochon prism, useful as a polarizer or analyzer in wavelengths longer than 1300A is described. Measurements of MgF2 transmission and of polarizer angular beam deviation from 1150 to 2900A are presented. The prism is comprised of 2.25 mm, MgF2 depolarizers, optically contacted. At normal incidence, a 4% transmission gain was measured from 6000 to 2200A, compared with air spaced elements. One depolarizer was vibrated to 40 g from 20 to 3500 Hz without deterioration in optical contact. Transmissions below 1400A are not good. In thin samples, surface loss is twice absorption loss in the range 1150 to 1500A. Refraction indices and a computer ray trace were used in processing photographic beam divergence data. If care is taken to remedy scattering effects, the prism is an efficient on-axis polarizer in the 1300 to 3000A range.

Author (ESA)

**N82-14917#** Centre National de la Recherche Scientifique, Bellevue (France). Lab. des Hautes Pressions.

**ANOMALOUS DISPERSION OF BIREFRINGENCE OF SAPPHIRE AND MAGNESIUM FLUORIDE IN THE VACUUM ULTRAVIOLET**

V. Chandrasekharan and H. Damany *In its* FOC F/96 Polarizers 17 Sep. 1980 5 p refs Repr. from Appl. Opt., v. 8, no. 3 Mar. 1969 p 671-675 (For primary document see N82-14915 05-74)
Avail: NTIS HC A06/MF A01

Previous measurements of the birefringence of sapphire and magnesium fluoride were extended to their respective limits of transparency, revealing anomalous dispersion effects at short wavelengths, e.g. a change of birefringence sign after passing through zero, in the case of MgF2. Applications of these effects are proposed. The stationary nature of retardation near lambda g, 1390A for MgF2 and 1555A for sapphire, is equivalent to achromatism which can be exploited over a limited domain of about 40A near lambda g. Near lambda 0, 1194 and 1426A, phase retardation change arises from the rapid variation of delta n, 0.0143 and 0.0130. The various orders are closely spaced, so relatively thin plates of MgF2 could be used as birefringent Lyot filters to study a weak line in the presence of a strong line from 1140 to 1250A. In optical pumping experiments on atomic hydrogen, a quarter wave MgF2 phase retarder is more practical than reflection by Al mirrors at 45 deg azimuth.

Author (ESA)

**N82-14918#** Atmospheric Sciences Lab., White Sands Missile Range, N. Mex.

**DUST CLOUD MODELS: SENSITIVITY OF CALCULATED TRANSMITTANCES TO VARIATIONS IN INPUT PARAMETERS Final Report**

Melvin G. Heaps Jun. 1981 57 p refs
(DA Proj. 1L1-601102-B-53-AB)
(AD-A103310; ERADCOM/ASL-TR-0090) Avail: NTIS HC A04/MF A01 CSCL 20/6

The modeling of the transmission of visible an infrared radiation through artillery produced dust clouds depends on several quantities, processes, and assumptions which are parameterized either as scaling laws and multiplicative factors or are specified directly as input values. Several parameters from the different phases of dust cloud transmission problems are varied within appropriate ranges. The more important parameters which can cause wide variations in the calculated transmittance are: the fraction of the actual crater mass remaining airborne, which affects the degree of obscuration; wind direction, which affects the position of the cloud with respect to the transmisssion line of sight; and the dust particle size distribution within the cloud, which affects the wavelength dependence of the obscuration.

Author

**N82-14919#** ITT Electro-Optical Products Div., Roanoke, Va.

**MANUFACTURING METHODS AND TECHNOLOGY PROGRAM FOR RUGGEDIZED TACTICAL FIBER OPTIC CABLE Progress Report, Jul. 1980 - Mar. 1981**

J. Smith and C. Hand Fort Monmouth, N.J. Army Communication Research and Development Command Apr. 1981 50 p
(Contract DAAK80-79-C-0789)
(AD-A105717; CORADCOM-79-0789-5; PR-5) Avail: NTIS HC A03/MF A01 CSCL 20/6

This report covers manufacturing methods and technology program for ruggedized tactical fiber optic cable. The scope of this effort, as reported herein, includes the following tasks and achievements: (a) Cable process optimization -- (1) Produce trial runs of confirmatory; (2) Complete lay length samples (two lays); (3) Perform optical and mechanical tests on trial confirmatory samples; and (4) Produce samples and evaluate polyurethanes (three types). (b) Use of facilities -- (1) Operate high speed strander, Kevlar braider, and extruder at production speeds. (c) Secondary performance -- (1) Evaluate low temperature performance. GRA

**N82-14920#** Naval Postgraduate School, Monterey, Calif.

**STUDY OF THE PERFORMANCE PARAMETERS OF A FLIR SYSTEM M.S. Thesis**

Yong Bok Lee and Chang Hyun Park Jun. 1981 40 p refs
(AD-A105865) Avail: NTIS HC A03/MF A01 CSCL 17/5

The performance parameters of Detectivity and Noise Equivalent Temperature Difference for a Forward Looking Infra-Red (FLIR) system were measured after optimization of the system. The achieved performance approached the theoretically evaluated limiting values. GRA

**N82-14921#** Farrand Optical Co., Inc., Valhalla, N.Y.
**LOW COST, WIDE ANGLE INFINITY OPTICS VISUAL SYSTEM Final Report**
Jose R. Magarinos, Daniel J. Coleman, and Ted Lenezowski Brooks AFB, Tex. Air Force Human Resources Lab. Sep. 1981 144 p
(Contract F33615-76-C-0055; AF Proj. 1958)
(AD-A105508; AFHRL-TR-80-54) Avail: NTIS HC A07/MF A01 CSCL 14/5

Holographic beamsplitter spherical mirrors have been introduced in the Pancake Window visual simulators as a low-cost and low-weight substitute for the classical glass beamsplitter spherical mirrors. The goal of this project was the production of a three-channel visual simulator consisting of a mosaic of three holographic Pancake Windows in which these beamsplitter spherical mirrors are used. The field of view of the complete display is 45 deg vertical and 140 deg horizontal and will be used to demonstrate a dynamic, unprogrammed visual simulation imagery generated by T.V. camera/model and gantry image generator. Prior to the production of the holograms, holographic research was carried out to investigate and resolve problems which have affected the quality and the repeatability of the final product. Specific attention was given to holographic ghost images which seriously impaired the contrast and the resolution of the images produced by the holographic Pancake Window and to the effects of environmental controls. The final production of the holographic beamsplitter was delayed by a stability problem in the wet cell used to support the holographic plate during the holographic exposure. The phosphors in the CRT displays were originally designed to be P-44 narrow band phosphors but were later changed to a wide-band emission phosphor. The reason for this was a wavelength peak response shift of the holograms with large field-of-view angles. The use of a wide-band phosphor, although it penalized the transmission of the holographic Pancake Window, required less stringent wavelength peak location in the manufacture of these holographic beamsplitter mirrors. GRA

**N82-14922#** Oak Ridge National Lab., Tenn. Instrument and Controls Div.
**EVALUATION OF FIBER OPTICS FOR IN-LINE PHOTOMETRY IN HOSTILE ENVIRONMENTS**
M. L. Bauer, D. A. Bostick, and J. E. Strain 1981 12 p refs Presented at the 25th Ann. Intern. Tech. Symp. and Exhibit of the Soc. of Photo-Opt. Instrumentation Engr., San Diego, Calif., 24-28 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028139; CONF-810810-21) Avail: NTIS HC A02/MF A01

Commercial fiber optics cables, both bundled and single-fiber, are evaluated for application in an in line photometer being developed for monitoring uranium and plutonium concentrations in high radiation environments in nuclear fuel reprocessing plants. The relative attenuation of the optical signals due to both the radiation damage and to the couplings between lengths of optical cable was determined for specimen cables. An ultraviolet enhanced fiber bundle demonstrated good radiation resistance to a total dose of one hundred million rads, which is the dose estimated to be received during a 1-y lifetime of the in cell portion of the photometer. The photometer is designed to use a single fiber optical cable with adequate radiation shielding. DOE

**N82-14923#** California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
**SUB-GAP AND BAND EDGE OPTICAL ABSORPTION IN A-Si:H BY PHOTOTHERMAL DEFLECTION SPECTROSCOPY**
W. B. Jackson and Nabil M. Amer Jul. 1981 4 p refs Presented at the 9th Intern. Conf. on Amorphous and Liquid Semicond., Grenoble, France, 2-8 Jul. 1981 Submitted for publication
(Contract W-7405-eng-48)
(DE81-028040; LBL-13040; CONF-810719-2) Avail: NTIS HC A02/MF A01

Using photothermal deflection spectroscopy, the optical absorption of various a-Si:H films was investigated in the range of 2.1 to 0.6 eV. An absorption shoulder which depends on deposition conditions and on doping was found and was attributed to dangling bonds. The exponential edge broadens with increasing spin density. DOE

**N82-14924#** Physics Lab. RVO-TNO, The Hague (Netherlands). Research Group 1: Physics.
**STATISTICAL MEASUREMENT OF THE 1978 LIDAR MEASUREMENTS**
C. W. Lamberts Nov. 1980 64 p refs Document includes a microfiche supplement
(Contract A78/KL/121)
(PHL-1980-41; TDCK-75026) Avail: NTIS HC A04/MF A01

Analysis for combined lidar aerosol and meteorological measurements are presented. The data are used for the remote deduction of atmospheric parameters. Analytical relations are based on statistics, not on physical laws. Results show that wind direction has an important influence on visibility, backscatter, and extinction. Extinction is difficult to calculate, especially when visibility is good, so a large range of measured extinction is shown. An increasing spread in backscatter is present at high visibility due to aerosol distribution properties. Aerosol properties can be deduced from meteorological and/or lidar measurement. Author (ESA)

**N82-14153#** European Space Operations Center, Darmstadt (West Germany).
**A SIMPLE APPROACH TO SOLVE THE METEOSAT IMAGE DEFORMATION PROBLEM BASED ON HORIZON EXTRACTION FROM IMAGE DATA AND ORBIT INFORMATION**
T. Wolff *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 293-298 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and NO (+20% others)

## 75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**N82-14925#** Naval Research Lab., Washington, D. C.
**PLASMA CONDITIONS REQUIRED FOR ATTAINMENT OF MAXIMUM GAIN IN RESONANTLY PHOTO-PUMPED Al 12 AND Ne 9**
J. P. Apruzese (Science Applications, Inc., McLean, Va.), J. Davis, and K. G. Whitney 9 Oct. 1981 25 p refs Sponsored in part by Defense Nuclear Agency
(AD-A105779; NRL-MR-4618) Avail: NTIS HC A02/MF A01 CSCL 20/9

We present a detailed analysis of the plasma conditions required to optimize gain in two proposed X-ray lasing schemes using resonant photo-pumping. In one proposed configuration, the Si XIII line 1s2-1s2p1P at 6.650 A pumps Al XII 1s2-1s3p1P at 6.635 A, inverting the Al XII n=3 and N=2 levels which are separated by 44 A. A similar approach which utilizes the Na X 1s2-1s2p1P line at 11.00 A to pump the Ne IX 1s2-1s4p 1P line at 11.001 A would invert the n=3 and n=2 levels of Ne IX, separated by 82 A. Conditions in the pumped neon and aluminum plasmas, and in the pumping silicon plasma, are calculated using a multistage, multilevel atomic model with multi-frequency radiation transport. Temperatures required to maximize gain in the pumped plasmas are found to be 50 eV and 100 eV, for neon and aluminum, respectively. Plasmas of lower temperature do not contain enough of the active ion species, whereas at higher temperatures the photon pumping of the upper levels results in excessive ionization from these levels to the hydrogen-like species. Finally, since the pumping silicon and pumped aluminum lines are slightly off resonance, we have investigated the effect of streaming the plasmas toward each other at various velocities to offset some or all of the wavelength difference. GRA

**N82-14926#** Naval Research Lab., Washington, D. C.
**MIROWAVE ENERGY DEPOSITION, BREAKDOWN AND HEATING OF NITROGEN AND AIR**
C. L. Yee (Mission Research Corp., Alexandria, Va.) and A. W. Ali 16 Oct. 1981 37 p refs
(WF34388501)
(AD-A105749; NRL-MR-4617) Avail: NTIS HC A03/MF A01 CSCL 09/3

A comprehensive code is developed for the microwave energy deposition in N2 to describe the breakdown and heating of nitrogen. The microwave absorption and reflection from a nitrogen plasma is based on wave optics. The ionization and the deionization of N2, however, is described in detail by an N2 chemistry code (CHEM-N2) which provides plasma diagnostics capabilities by calculating emission intensities of the second positive and the first negative band systems of N2 and N2+. The code is applied to breakdown calculations in N2 and the results are in reasonable accord with experimental data. The wave optics code for energy deposition is also coupled to an air chemistry code (CHMAIR) to describe the breakdown off a reflecting surface. An insight is provided into the plasma absorption by using a simple lab density profile for the electrons. This models roughly the profile expected in air breakdown off a reflecting surface. Simulation results show a steep localized electron density profile at the interference maximum. GRA

**N82-14927#** Universal Energy Systems, Inc., Dayton, Ohio.
**INVESTIGATION OF PLASMA EXCITATION. VOLUME 1: ELECTRON IMPACT STUDIES OF SELECTED GROUND STATE AND EXCITED STATE RARE GAS ATOMS Final Report, 7 Jun. 1977 - 20 Sep. 1980**
Max L. Lake Wright-Patterson AFB, Ohio AFWAL Aug. 1981 44 p refs 3 Vol.
(Contract F33615-77-C-3113; AF Proj. 2301)
(AD-A105494; AFWAL-TR-81-2082-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

Experiments were undertaken to determine electron impact cross sections of atoms in metastable states. One or two electron guns were used to first produce atoms in metastable states, then further excite these atoms to other levels. Limits on certain cross sections of helium atoms were obtained, but the detection limits of the apparatus prevented exhaustive study. Excitation functions and cross sections of xenon were obtained in the wavelength range from 3000 A to 9000 A. GRA

**N82-14928#** Universal Energy Systems, Inc., Dayton, Ohio.
**INVESTIGATION OF PLASMA EXCITATION. VOLUME 2: MICROWAVE PLASMAS Final Report, 7 Jun. 1977 - 20 Sep. 1980**
V. E. Merchant Wright-Patterson AFB, Ohio AFWAL Aug. 1981 109 p refs 3 Vol.
(Contract F33615-77-C-3113; AF Proj. 2301)
(AD-A105495; Rept-707-2-F; AFWAL-TR-81-2082-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 07/4

Two different commercially available microwave applications were used to excite plasmas in electrodeless discharge tubes. Plasmas in a variety of gases and gas mixtures were investigated, including mercury, mercury bromide, xenon and hydrogen chloride, thallium iodide and mercury, thallium iodide and xenon, and sulfur. Approximately 35% of the total emission from tubes containing mercury and metallic halide additives occurred in the ultra-violet (220-350 nm). However, extensive self-trapping occurred, and the emission was greatest in tubes with low partial pressures, about 100 Torr of the component materials. Pulsed discharges in mercury bromide produced emission from mercurous bromide, but the application of continuous microwave power resulted in total dissociation and the observed emission was due to atomic mercury. Pulsed microwave discharges in tubes containing xenon and hydrogen chloride resulted in emission from two bands of the xenon chloride excimer. No excimer emission was seen from discharge tubes containing xenon and thallium iodide, or mercury and thallium iodide. In both cases, the density of the volatile component could not be increased with the available equipment to the value necessary for excimer formation. Discharges in tubes containing sulfur resulted in emission from diatomic sulfur which extended from 280 nm to 500 nm. GRA

**N82-14929#** Universal Energy Systems, Inc., Dayton, Ohio.
**INVESTIGATION OF PLASMA EXCITATION. VOLUME 3: ADVANCED OPTICAL DIAGNOSTICS OF PLASMAS Final Report, 7 Jun. 1977 - 20 Sep. 1980**
C. A. DeJoseph Wright-Patterson AFB, Ohio AFWAL Aug. 1981 126 p refs 3 Vol.
(Contract F33615-77-C-3113; AF Proj. 2301)
(AD-A105496; Rept-707-3-F; AFWAL-TR-81-2082-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 20/9

A fourier transform infrared spectrometer was used to identify infrared absorption spectra of impurities that might be present in carbon dioxide laser discharges. Spectral regions free from interference from the primary constituents and common impurities such as water vapor were identified for several of the nitrogen oxides, and the detection sensitivities were determined. This information was used in a study of impurity buildup during discharges in an electron-beam excited closed cycle (EBCC) system and in a TEA CO2 laser. It was found that after an hour of irradiation in the continuous EBCC system, the oxides of nitrogen had built up to the ten parts per mission range while the carbon monoxide concentration was of the order of a few hundred parts per million. When the initial gas mix contained oxygen, the concentration of carbon monoxide and the nitrogen oxides increased. The addition of hydrogen to an oxygen free gas mix was found to produce water vapor at about ten percent of the initial hydrogen concentration, increase the production of N20 and of CO, and decrease the production of NO and NO2. A technique has been developed for determining the rotational temperature and vibrational population distribution of non-homonuclear molecules under nonequilibrium conditions. The technique was applied to carbon monoxide under the conditions present in an electrical discharge. GRA

**N82-14930#** Oak Ridge National Lab., Tenn. Fusion Energy Div.
**FIELD ERRORS IN EBT AND THEIR EFFECTS ON THE AMBIPOLAR POTENTIAL**
T. Uckan, F. M. Bieniosek (Rensselaer Polytechnic Inst., Troy, N.Y.), and L. Solensten (Rensselaer Polytechnic Inst., Troy, N.Y.) Oct. 1981 36 p refs
(Contract W-7405-eng-26)
(DE82-000828; ORNL/TM-7912) Avail: NTIS HC A03/MF A01

Because the ELMO Bumpy Torus (EBT) is a closed field line device, it is very sensitive to small magnetic field asymmetries - field errors (RADICAL) B/B less than or equal to 1.5 x 10(+4)). Such field errors are unavoidable due to minute coil misalignments (0.25 mm) and the ubiquitous Earth's field (B approx. 5 x 10(+5) T). If the inherent error field of the device is large enough, it causes: (1) a distortion of the poloidal symmetry of the potential profile and even a total disappearance of the ambipolar potential well, leading in turn to a deterioration of the plasma confinement parameters; (2) the establishment of a toroidal current and, therefore, enhancement of fluctuations; and (3) an opening of the confined closed drift surfaces that increase particular diffusion. DOE

**N82-14931#** Oak Ridge National Lab., Tenn.
**REVIEW OR RECENT EBT COUPLED RING-CORE STABILITY THEORY**
D. A. Spong Oct. 1981 32 p refs
(Contract W-7405-eng-26)
(DE82-000880; ORNL/TM-8021) Avail: NTIS HC A03/MF A01

During the past several years Elmo Bumpy Torus (EBT) stability calculations have evolved with respect to treatment of ring-core plasma coupling effects. This evolution began with recognition of the important role of ring compressibility and paramagnetic effects on core beta limits. Since then, models have continued to increase in sophistication, incuding ring-core frequency coupling, velocity space and hot electron distribution function effects, and radially dependent models. Some of these features resulted in wide variations in predicted plasma performance limitations. A number of the models are reviewed and assumptions to which they are particularly sensitive are discussed. DOE

**N82-14932#** Columbia Univ., New York. School of Engineering and Applied Science.
**DARK-GROUND ILLUMINATION: A QUANTITATIVE DIAGNOSTIC FOR PLASMA DENSITY Ph.D. Thesis**
Stephen Frederick Paul 1981 175 p refs
(Contract DE-AS02-76ET-53016)
(DE82-000442; DOE/ET-53016/74) Avail: NTIS HC A08/MF A01

Radial electron density profiles of a toroidal belt pinch plasma

were obtained by a single measurement. Collimated ruby laser light, incident on the plasma, is focused to a diffraction limited spot (100 (SIGMA)m). The technique, a variation of the dark-ground microscope, involves masking the center of the plasma diffraction pattern with a thin wire. Undiffracted light is blocked by a thin wire, whereas light diffracted by the plasma passes around the wire and onto a photoplate. The resulting interference generates a high contrast fringe pattern whose intensity varies as 1-cosine (RADICAL) phi, where (RADICAL) phi is the phase shift induced by the plasma. The fringes are recorded on Polaroid type 46L transparency film. Using this technique, radial density profiles of the plasma produced in the Columbia Torus 1 belt pinch have been measured. The plasma minor cross section is elliptical with a approx. 2 cm. Beta approx. 30 cm and < n(0) > approx. 3 x 10 to the 16th power/cu cm (3) . Average densities as low as 2 x 10 to the 15th power/cu cm (3) were measured. DOE

**N82-14933#** California Univ., Livermore. Lawrence Livermore Lab.
**TANDEM-MIRROR TECHNOLOGY DEMONSTRATION FACILITY**
T. Kenneth Fowler and B. Grant Logan 18 Sep. 1981 13 p ref
(Contract W-7405-eng-48)
(DE81-030878; UCID-19193) Avail: NTIS HC A02/MF A01

Preliminary calculations for a technology demonstration facility consisting of a tandem mirror machine are reported. This machine produces 12 MW of DT neutrons in steady state from a plasma column 0.08 m in radius and 8 m in length. Allowing space for neutral beam injectors at each end of the column, this permits testing of blanket modules and components at 1 MW/sq m neutron wall load over a cylindrical surface 8 sq m in area at a radius o 0.25 m; or irradiation of thousands of small samples at 2 MW/sq m at r = 0.125 m (4 sq m area). DOE

**N82-14934#** California Univ., Berkeley. Charged Particle Research Lab.
**INVESTIGATION OF METHODS FOR FABRICATING, CHARACTERIZING AND TRANSPORTING CRYOGENIC INERTIAL-CONFINEMENT-FUSION TARGETS**
James J. Fanning and Kyekydon Kim Jan. 1981 94 p refs Prepared for California Univ., Berkeley Lawrence Berkeley Lab.
(Contract W-7405-eng-48)
(DE81-029737; UCRL-15360; Rept-1-81) Avail: NTIS HC A05/MF A01

A microprocessor-based data acquisition system was built that converts a complete target image to digital data, which are then analyzed by automated software procedures. The low temperatures required to freeze the hydrogen isotopes contained in a target is provided by a cryogenic cold chamber capable of attaining 15 K. A method for target manipulation and positioning is studied that employs molecular gas beams to levitate a target and an electrostatic quadrupole structure to provide for its lateral containment. Since the electrostatic target-positioning scheme requires that the targets be charged, preliminary investigation has been carried out for a target-charging mechanism based on ion-bombardment. DOE

**N82-14935#** Paris-Sud Univ., Orsay (France). Lab. de Physique des Plasmas.
**STUDY OF METASTABLE STATES OF ATOMIC NITROGEN IN LUMINESCENT DISCHARGES [ETUDE DES ETATS METASTABLES DE L'AZOTE ATOMIQUE DANS DES DECHARGES LUMINESCENTES]**
G. Cernogora Jan. 1981 202 p refs In FRENCH
(LP-185) Avail: NTIS HC A10/MF A01

For the first and second metastable states of nitrogen atoms, the diffusion coefficient and the coefficient of occurrence of these states due to electronic collisions were determined. The kinetic behavior of these metastable atoms was established by optical absorption measurement in the far UV. Results show that the coefficients of electronic excitations can be deduced from measurements of the concentration of these states in a luminescent discharge. The diffusion coefficient is found by analyzing the evolution of their concentration in a post-discharge. The saturation limit at which concentration of metastable states no longer increases with electron density is also identified. Author (ESA)

**N82-14936#** Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
**A THERMODYNAMIC APPROACH TO METAL-PLASMA INTERACTION IN ONE-DIMENSIONAL STATIONARY EVOLUTION [UNE APPROCHE THERMODYNAMIQUE DE L'INTERACTION METAL-PLASMA EN EVOLUTION UNIDIMENSIONNELLE STATIONAIRE]**
Roger PrudHomme and Michel Dudeck Jan. 1981 88 p refs In FRENCH
(Rept-81-1; Publ-638) Avail: NTIS HC A05/MF A01

The production of entropy and phenomenological relations in a thermally unstable plasma are discussed. Evolution of the plasma electric potential is described macroscopically. A metallic surface in the presence of heat transfer and electrical conduction is depicted one dimensionally. A system of difference equations was solved. Expressions for the characteristic equation near equilibrium and for the specific rates of adsorption and desorption in function of electron density, electron energy, and plasma flow are given. The significance of the coefficients of diffusion is pointed out. Author (ESA)

**N82-14937#** Paris-Sud Univ., Orsay (France). Lab. de Physique des Plasmas.
**STUDY OF A DISCHARGE CAUSED BY A SURFACE WAVE [ETUDE D'UNE DECHARGE CREEE PAR UNE ONDE DE SURFACE]**
M. Chaker, P. Nghiem, E. Bloyet, P. Leprince, and J. Marec May 1981 159 p refs In FRENCH
(LP-190) Avail: NTIS HC A08/MF A01

A plasma generation theory is elaborated which is based on surface wave propagation characteristics and the hypothesis that the energy absorbed from the wave is proportional to the number of electrons in the plasma, the proportionality factor being independent of the power. Experimentally, the validity of this hypothesis was verified in a rare gas cavity resonator. Direct application of this model makes possible calculation of the effective collision frequency for each experimental condition (excitation frequency). From the collision rate, the mean electron temperature is deduced, assuming a Maxwell distribution. An approximation of losses in the plasma is obtained. Author (ESA)

# 76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

**N82-14938#** Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Mining and Metallurgy.
**STUDIES OF VACANCY: TYPE DEFECTS IN METALS Ph.D. Thesis**
Juhani Johansson 1981 27 p refs Sponsored in part by the Jenny and Antti Wihuri Foundation, the Eemil Aaltonen Foundation, the Finnish Cultural Foundation, CNRS and ACTIM
Avail: NTIS HC A03/MF A01

The positron annihilation technique was applied in studying the elementary properties of vacancies, vacancy interaction with impurities and vacancy clustering in metals on such an atomic scale that these phenomena are not detectable in the electron microscope. The vacancy migration temperature and some features of the vacancy-carbon interaction in iron, the vacancy properties and behavior of irradiated silver, the annealing behavior of electron irradiated chromium, and the quenched-in, irradiation induced and thermal vacancies in magnesium are considered. A.R.H.

**N82-14939#** Katholieke Universiteit, Nijmegen (Netherlands).
**KINETICS STUDIES ON THE NUCLEATION AND GROWTH OF SILICON VIA CHEMICAL VAPOUR DEPOSITION Ph.D. Thesis**
Wilhelmus Antonius Petrus Claassen 27 Feb. 1981 178 p refs
Avail: NTIS HC A09/MF A01

The grain size in polycrystalline silicon layers is subject to

various external conditions among which the initial nucleation of silicon on the substrate may play a decisive role. This article describes experiments with silicon on SiO2 and Si3N4 substrates in the SiH4-HCl-H2 system for temperatures between 925 and 1200 C. The saturation cluster densities are determined as a function of gas phase composition and temperature and could be varied between 10 to the fourth power - 10 to the eleventh power per sq cm. The experimental results are compared with predictions of existing nucleation theories using analysis of the monomer silicon adatom concentration. In this way the nucleation can be described satisfactorily and approximate values for the size of the critical cluster can be derived. Author

**N82-14940#** EIC, Inc., Newton, Mass.
**PHOTOELECTROCHEMICAL DEPOSITIONS OF MICROSCOPIC METAL FILM PATTERNS ON Si AND GaAs**
Ronald H. Micheels, Allan D. Darrow, II, and R. David Rauh May 1981 18 p refs
(Contract N00014-79-C-0700; NR Proj. 359-723)
(AD-A099456; TR-2) Avail: NTIS HC A02/MF A01 CSCL 20/12

Microscopic metal film patterns were imaged on p-Si and n- and p-GaAs by photoelectrochemical deposition from standard aqueous plating solutions. The photodeposition of Cu, Ni, Pd and Au films was investigated. Resolution exceeding 10 microns was achieved for deposits on Au on p-GaAs and Cu on p-Si. Author

**N82-14941#** Indiana Univ. at Bloomington. Dept. of Chemistry.
**CRYSTAL AND MOLECULAR STRUCTURE OF Mo6O10 (OPr (I))12: A SERPENTINE CHAIN OF MOLYBDENUM ATOMS AND OBSERVATION OF SEMIBRIDGING ALKOXY LIGANDS**
Malcolm H. Chisholm, Kirsten Folting, John C. Huffman, and Charles C. Kirkpatrick 14 Oct. 1981 12 p refs Submitted for publication
(Contract N00014-79-C-0044)
(AD-A105769; TR-81-5) Avail: NTIS HC A02/MF A01 CSCL 20/2

Mo6O10(OPr(1)12, an intermediate in the reaction between Mo2 (OPr(1))6 and molecular oxygen which yields (MoO2 (OPr(1)) 2)n, has been structurally characterized and found to contain a serpentine chain of molybdenum atoms connected by bridging oxo and alkoxy ligands; there is also a pair of alkoxy ligands which are semibridging. GRA

**N82-14942#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**AMORPHOUS-CRYSTALLINE BOUNDARY DYNAMICS IN LASER CRYSTALLIZATION**
Herbert J. Zeiger, John Chin C. Fan, Barbara J. Palm, Ralph L. Chapman, and Ronald P. Gale 25 Aug. 1981 76 p refs
(Contract F19628-80-C-0002; AF Proj. 649L)
(AD-A105811; TR-558; ESD-TR-81-85) Avail: NTIS HC A05/MF A01 CSCL 20/5

Two theoretical descriptions have been developed for the phase boundary dynamics during crystallization of amorphous films by scanning with the slit image of a cw laser or of any cw energy beam. The first reduces the problem to the solution of a one-dimensional integral equation, which allows a choice of initial conditions. Depending on the background temperature, numerical solutions yield either periodic or runaway motion of the amorphous-crystalline (a-c) boundary, as observed in experiments on scanned laser crystallization of thin films of a-Ge on fused-silica substrates. The calculations give a semi-quantitative fit to the experimental results for the spatial periodicity observed in the crystallized films as a function of background temperature. Profiles of film temperature as a function of distance from the laser image at successive times have been computed for both the periodic and runaway cases. The model qualitatively explains many of the effects observed during scanned cw laser crystallization, including periodic fluctuations in light emission. The second theoretical description is a more exact two-dimensional treatment, applicable only to cases of steady-state motion of the a-c boundary, which rigorously handles heat flow into the substrate. This treatment has been used to calculate the boundary velocity during steady-state runaway. GRA

**N82-14943#** Cornell Univ., Ithaca, N. Y. Materials Science Center.
**POINT DEFECTS IN CRYSTALS (INCLUDING GROUPED DEFECTS)**
David N. Seidman Aug. 1981 21 p refs
(Contract DE-AS02-76ER-03158)
(DE82-000395; DOE/ER-03158/97; MSC-4548) Avail: NTIS HC A02/MF A01

The fundamental properties of point defects, vacancies and self-interstitial atoms, in pure fcc and bcc metals is reviewed. Point defects created by both thermally-activated and irradiation processes are considered. The roles played by vacancies and self-interstitial atoms in thermal equilibrium are discussed and the best values of the enthalpy of formation of these point defects, in a number of metals, are given. Methods for obtaining fundamental properties of vacancies, such as activation volumes, mobilities, and binding enthalpies are discussed. Selected best values of mobilities and binding enthalpies of vacancies, as deduced from recovery experiments on a number of different quenched metals are listed. The problem of the production of single self-interstitial atoms and their configuration(s) is discussed. The clustering of single self-interstitials into small clusters is also considered. The physical origin of the extremely high low-temperature mobility of self-interstitials in the so-called Stage 1 recovery regime is also discussed. DOE

**N82-14944#** Cornell Univ., Ithaca, N. Y.
**POINT-DEFECT SOURCES AND SINKS**
D. N. Seidman Aug. 1981 9 p refs
(Contract DE-AS02-76ER-03158)
(DE82-000655; DOE/ER-03158/98) Avail: NTIS HC A02/MF A01

The role played by sources and sinks of point defects is of importance in understanding a wide range of physical phenomena. The problem of the efficiency (eta) of a sink (or sources) and its relatonship to the super (or sub) saturation of point defects which drives the process is considered. A qualitative discussion is given of the atomic mechanisms by which the following defects act as sources and sinks: (a) the free surface; (b) voids; (c) dislocation loops; and (d) grain boundaries. Examples of specific values of eta are given for different experimental situations. DOE

**N82-14945#** Oak Ridge National Lab., Tenn.
**DAMAGE STRUCTURE IN NIMONIC PE16 ALLOY ION BOMBARDED TO HIGH DOSES AND GAS LEVELS**
K. Farrell and N. H. Packan 1981 4 p refs Presented at the Fusion Reactor Materials Meeting, Seattle, 9 Aug. 1981
(Contract W-7405-eng-26)
(DE81-028562; CONF-810831-25) Avail: NTIS HC A02/MF A01

The Nimonic PE16 alloy in solution-treated-and-aged condition was bombarded simultaneously with nickel ions and alpha and deuteron beams at 625 C to doses of 80 to 313 dpa at He/dpa - 10 and D/dpa = 25. Microstructural changes consisted of the introduction of dislocations and of cavities, and the redistribution of gamma prime precipitates to these defects. Cavitational swelling remained below 1%. Cavities were represented by several distinct size classes, the smaller ones believed to be gas bubbles, and some larger ones associated with preferred growth of precipitate. Formation of bubbles at grain boundaries, and large cavities at incoherent twins intensified the possibility of mechanical separation of interfaces under high-gas irradiation conditions. DOE

**N82-14946#** Los Alamos Scientific Lab., N. Mex.
**RELAXATION EFFECTS IN SHOCK-INDUCED TRANSITIONS IN BISMUTH**
T. R. Neal 1981 6 p refs Presented at the 8th AIRAPT Conf. and 19th EHPRG Conf., Uppsala, 17 Aug. 1981
(Contract W-7405-eng-36)
(DE81-028728; LA-UR-81-2338; CONF-810827-6) Avail: NTIS HC A02/MF A01

The baratol experiments indicate that as the shock in the mixed region progresses and decays, the lead state does not change along a stable Hugoniot but appears to change from a sort of metastable Hugoniot, in accordance with Romain's data, to a stable Hugoniot reminiscent of the earlier results. If this is so, then the Bi I-III transition is exhibiting a relaxation effect

similar to that seen in the Sb I-III transition. The transition detected by Romain could then be interpreted as the II-III transition seen in the metastable region. The few experiments outlined here merely hint at an explanation. Additional precision work in the stress range 6 to 10 GPa, some with thin samples, is needed to resolve this behavior. DOE

**N82-14947#** Sandia Labs., Albuquerque, N. Mex.
**ION-IMPLANTATION EFFECTS IN GLASSES**
G. W. Arnold 1981 37 p refs Presented at the Intern. Conf. on Radiation Effects in Glasses, Arco, Italy, 30 Jun. 1981
(Contract DE-AC04-76DP-00789)
(DE81-027208; SAND-81-0819C; CONF-8106132-1) Avail: NTIS HC A03/MF A01

Ion implantation can be used to introduce network damage and to alter the chemical composition in glasses. Structural changes can be inferred from IR measurements near 1000 per cm and by optical absorption near 2150 A. Implantation induced damage decreases the implanted volume in fused silica with consequent changes in the refractive index, near-surface hardness, and surface tensile stress. Prior work in these areas is reviewed. Implantation into alkali silicate glasses depletes the alkali content in the implanted region. These changes allow preferential surface crystallization in Li2O 2SiO2 glasses. Crystallization of amorphous SiO2 can be induced by implantation of Li. Insight into the crystallization process is obtained by observing the associated ion movement using elastic recoil detection and optical techniques. Results are of interest to studies of corrosion in glasses considered for nuclear waste encapsulation and for components in fusion reactors. DOE

**N82-14948#** Wacker-Chemie G.m.b.H. Burghausen (West Germany). Bereich GA.
**RESEARCH AND DEVELOPMENT ON TECHNOLOGIES FOR THE PREPARATION OF III-V SEMICONDUCTOR MATERIALS AND ON METHODS FOR EVALUATION OF THE QUALITY OF THESE MATERIALS: PRODUCTION OF GALLIUM PHOSPHIDE CRYSTALS Final Report**
Michael Blaette Bonn Bundesministerium fuer Forschung und Technologie Mar. 1981 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technol.
(BMFT-FB-T-81-021; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5,70

Methods for economic synthesis and crystal growth of gallium phosphide were developed. Polycrystalline ingots up to 800 gr of the dense and homogeneous quality necessary for crystal growth are currently produced with very good yield. The conditions for high pressure crystal growth by the liquid encapsulation technique were thoroughly investigated and optimized in a manner that permits industrial production of substrate quality crystals with a weight of 700 grams and a diameter of 50 mm. Diameter variations, common in the growth of GaP crystals, can be reduced to a few millimeters by a monitoring system based on crystal weighing. Author (ESA)

**N82-14949#** Wacker-Chemie G.m.b.H. Burghausen (West Germany). Bereich GA.
**RESEARCH AND DEVELOPMENT ON TECHNOLOGIES FOR THE PREPARATION OF III-V SEMICONDUCTOR MATERIALS AND ON METHODS FOR EVALUATION OF THE QUALITY OF THESE MATERIALS: GALLIUM ARSENIDE CRYSTALS, CRUCIBLE PULLING OF Ga As CRYSTALS Final Report**
Michael Blaette Bonn Bundesministerium fuer Forschung und Technologie Jan. 1981 38 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-022; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 7,80

The economic synthesis of the polycrystalline starting material was investigated. For the industrial production of gallium arsenide crystals, which are used as substrates for the epitaxial growth of basic material for light emitting diodes, the Czochralski liquid encapsulation technique was developed. After preliminary experiments in a small puller, the parameters for crystal growth were tested and optimized in pulling equipment which was specially constructed for this purpose. Methods for diameter control were tested as well. By means of production scale pulling of crystals with a diameter of 50 mm and a weight of 1.4 kg with dislocation densities of 50,000/sq. cm the objective was fully achieved. Author (ESA)

**N82-14950#** Wacker-Chemie G.m.b.H. Burghausen (West Germany). Bereich GA.
**RESEARCH AND DEVELOPMENT ON TECHNOLOGIES FOR THE PREPARATION OF III-V SEMICONDUCTOR MATERIALS AND ON METHODS FOR EVALUATION OF THE QUALITY OF THESE MATERIALS: GALLIUM ARSENIDE CRYSTALS, GRADIENT FREEZE CRYSTAL GROWTH AND MEASUREMENT TECHNIQUES Final Report**
Franz Kuhn-Kuhnenfeld Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 75 p refs Partly in GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-023; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 15,50

A gradient freeze technique was developed for the growth of GaAs crystals with low dislocation densities in closed quartz containers, using directional solidification. Such GaAs substrates are required for the manufacture of infrared light emitting diodes and other III-V devices. Crystal size (up to 1kg) and quality (crystal densities from 1000 to 10,000 cm E-2) are in accordance with present market requirements. The electrical parameters of III-V materials were determined by the van der Pauw method, and also by an eddy current method. Crystal perfection was evaluated by selective photoetching and chemical etching in H2SO4-H2O2-HF solution. Photoluminescense and photoelasticity measurements were also conducted on the III-V-materials.
Author (ESA)

**N82-14951#** Max-Planck-Institut fuer Festkoerperforschung, Stuttgart (West Germany).
**PREPARATION OF GaAs/AlxGa1-XAs MULTILAYER STRUCTURES WITH PREDETERMINED OPTICAL AND ELECTRICAL PROPERTIES BY MOLECULAR BEAM EPITAXY Final Report, Jun. 1980**
Klaus Ploog and Albrecht Fischer Bonn Bundesministerium fuer Forschung und Technologie Feb. 1981 68 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-81-042; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14,30

Semiconductor structures of GaAs-AlAs multilayers were developed for fundamental research microwave technology and optoelectronics applications. Measuring and evaluation procedures for molecular beam epitaxy (MBE) layers and semiconductor diodes were elaborated. Two semiconductor structures were studied: (1) periodic p/n doping multilayer structures ('nipi' structures) in GaAs consisting of a periodic sequence of ultrathin alternating p and n-doped GaAs layers, possibly with intrinsic (i-) layers in between, and (2) one-sided abrupt GaAs/n+-AlXgAl-XAs heterostructures producing two-dimensional carrier confinement and enhanced mobilities at the interface. The method performs better than previous MBE technologies. Author (ESA)

# 77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

**N82-14952** California Univ., Los Angeles.
**CALCULATIONAL ASPECTS OF QUANTUM GRAVITY Ph.D. Thesis**
Walter Mark Wilcox 1981 174 p

Avail: Univ. Microfilms Order No. 8122886

Weak field gravitational effects in the context of Schwinger's Source Theory are investigated. The first type of calculation considered is particle scattering from a weak, immoblie gravitational scattering center. Physical cross sections for scalar, vector (including photon) and graviton scattering from the weak source are developed. Next, gravitational scattering events between identical and nonidentical scalar particles are considered. The last cross section derived is for scalar-graviton scattering. Quantum gravitational corrections to physical processes are begun by calculating the first order correction to the photon propagation function. A series of causal calculations, aimed at isolating the gravitational contribution to the electron (or muon or tau) magnetic moment is then described. The regularization method used to carry out the last calculation is shown to respect the gravitational and electromagnetic gauge invariances. Dissert. Abstr.

**N82-14953#** California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Res. Div.

**THERMODYNAMICS OF ELECTROLYTE SOLUTIONS OVER THE ENTIRE MISCIBILITY RANGE**

Kenneth S. Pitzer Mar. 1981 9 p refs Presented at 2nd World Congr. of Chem. Engr., Thermodyn. of Electrolytes Session, Montreal, 4-8 Oct. 1981

(Contract W-7405-eng-48)

(LBL-12377: CONF-811007-1) Avail: NTIS HC A02/MF A01

It is shown that the properties of fully ionized aqueous electrolyte systems can be represented by relatively simple equations over wide ranges of composition. There are only a few systems for which data are available over the full range to fused salt. A simple equation commonly used for nonelectrolytes fits the measured vapor pressure of water reasonably well and further refinements are clearly possible. Over the somewhat more limited composition range up to saturation of typical salts such as NaCl, the equations representing thermodynamic properties with a Debye-Hueckel term plus second and third virial coefficients are very successful and these coefficients are known for nearly 300 electrolytes at room temperature. These same equations effectively predict the properties of mixed electrolytes. DOE

**N82-14954** Oregon Univ., Eugene.

**PHENOMENOLOGICAL APPLICATIONS OF PERTURBATIVE QUANTUM CHROMODYNAMICS Ph.D. Thesis**

Muhammad Sajjad Z. Zahir 1981 172 p

Avail: Univ. Microfilms Order No. 8123604

Topics in high energy particle physics, each of which is a case of theoretical and phenomenological application of perturbative quantum chromodynamics, are investigated. The first topic is the structure of nucleons as probed in deep inelastic lepton nucleon scattering. The structure functions of the nucleon are analyzed in the framework of the valon model in which a nucleon is assumed to be a bound state of three valence quark clusters (valons). In the second topic, the production of massive dimuons at large transverse momentum in Drell-Yan process where it is believed that the dimuons acquire large transverse momentum through the emission of absorption of hard gluons is studied. The third topic discusses how high energy photons can replace hadrons in a new lepton pair production process. Dissert. Abstr.

# 80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

**N82-14955*#** National Aeronautics and Space Administration, Washington, D. C.

**ORDERS OF MAGNITUDE: A HISTORY OF NACA AND NASA, 1915 - 1980**

Frank W. Anderson, Jr. 1981 113 p refs

(NASA-SP-4403) Avail: NTIS MF A01; HC SOD $4.75 CSCL 05D

The history of NACA and NASA from 1915 to 1980 is narrated. The impact of two world wars on aeronautics is reviewed. Research activity before and during World War II is presented. Postwar exploitation of new technologies is summarized. The creation of NASA and a comprehensive space program is discussed. Long range planning for a lunar mission is described. The Gemini project is reviewed. The Apollo project and side effects includng NASA's university and technology transfer programs are presented. Numerous scientific and application satellite projects are reviewed. The impact of budget reductions is explained. The value of space exploration is emphasized. Development of the Space Shuttle is reported. N.W.

# 81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**N82-14956#** University of Southern California, Los Angeles. Social Science Research Inst.

**RELIABILITY VS. DIAGNOSTICITY IN HIERARCHICAL INFERENCE**

Gregory M. Griffin and Ward Edwards Jun. 1981 32 p refs Sponsored in part by Decisions and Designs, Inc.

(Contract MDA903-80-C-0194)

(AD-A105628; SSRI-81-3) Avail: NTIS HC A03/MF A01 CSCL 05/1

This study examined the performance of subjects in a cascaded inference task where two subjects worked together, one subject having diagnosticity information and the other having reliability information. This was compared to a condition in which a single subject received both types of information. Additionally, the effects of different 'experts' having the power to make the final decision in the two-person conditions was explored. Seventy-two subjects made inferences about the probability of success vs. failure of hypothetical job applicants presented in a personnel manager scenario. Subjects were paid bonuses according to their performance on the task. Contrary to hypotheses, there were no between conditions differences. Single subjects performed just as well as subjects working together. This study replicates previous work using single subjects in the general pattern of responses: subjects were somewhat radical in comparison to the normative model. GRA

**N82-14957#** Stanford Univ., Calif. Center for Materials Research.

**MATERIALS RESEARCH AT STANFORD UNIVERSITY Annual Report, 1 Jul. 1980 - 30 Jun. 1981**

Jul. 1981 475 p refs

(Grant NSF DMR-77-24222)

(AD-A106108; CMR-81-7; AR-20) Avail: NTIS HC A20/MF A01 CSCL 05/1

This Twentieth Annual Report includes the total research activity related to the science of materials at Stanford University during the period July 1, 1980 through June 30, 1981. It contains brief descriptions of research programs active during this period. The report of the research programs is organized into two groupings: (1) the research programs of CMR Members who have participated in one of the five major Thrust group programs supported by the NSF-MRL block grant including their work on the Thrust program and other related research, and (2) individual research programs; when appropriate, members are included in both the Thrust and individual programs. As indicated in their descriptions, some of the research programs were supported by private sources. GRA

**N82-14958#** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

**[AEROSPACE RESEARCH ACTIVITIES] Annual Report, 1980**

1981 238 p refs

Avail: NTIS HC A11/MF A01

The activities of the ONERA in 1980 are reported. Research is reported in: fluid mechanics; aerodynamics; wind tunnel tests; structural design; engine design; measurement techniques; light alloys and composites; integrated systems; and control techniques. Author (ESA)

# 82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

**N82-14959#** Comptroller General of the United States, Washington, D.C.

**MILLIONS WASTED TRYING TO DEVELOP MAJOR ENERGY INFORMATION SYSTEM Report to the Congress**

15 May 1981 81 p refs

(AFMD-81-40) Avail: NTIS HC A05/MF A01

A Federal energy information system created to improve Federal and State energy regulation by providing computerized access to current energy data is reviewed. It is concluded that the system failed because management deficiencies existed in planning, development, and implementation. Moreover, the cost and progress of the system was not monitored. Poor communication among system developers and intended users at the Federal and State levels, lack of continuous involvement and support from top Federal management, and disruptions in both organization and personnel are also cited as reasons for the system's failure. R.J.F.

**N82-14960*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**TECHNICAL COMMUNICATION: PERSPECTIVES FOR THE EIGHTIES, PART 1. PROCEEDINGS OF THE TECHNICAL COMMUNICATIONS SESSIONS AT THE 32ND ANNUAL MEETING OF THE CONFERENCE ON COLLEGE COMPOSITION AND COMMUNICATION**

J. C. Mathes, comp. (Michigan Univ., Ann Arbor) and Thomas E. Pinelli, comp. Dec. 1981 307 p refs Conf. held in Dallas, 26-28 Mar. 1981

(NASA-CP-2203-Pt-1; L-14899) Avail: NTIS HC A14/MF A01 CSCL 05B

Proceeding of the technical communication sessions at the 32nd annual meeting of the Conference on College Composition and Communication held in Dallas, Texas, March 26-28, 1981 are summarized. The proceeding suggest that technical communication has become an important subfield and is becoming an intrinsic part of many undergraduate curricula. Technical communication as a separate discipline, however, is relatively new. For that reason, proceedings that can make current research available as quickly as possible are suggested for preparation. The following topics were addressed: (1) a history and definition of technical writing, (2) the case method is technical communication (3) teaching technical writing (4) oral communication and rhetorical theory, and (5) new approaches in and practical applications of technical writing. For individual titles, see N82-14961 through N82-14979.

**N82-14961*#** Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.

**WHAT IS TECHNICAL WRITING? PROLEGOMENON TO A CONTEXTUAL DEFINITION**

Ben F. Barton and Marthalee S. Barton *In* NASA. Langley Research Center Tech. Commun. Pt. 1 Dec. 1981 p 3-14 refs (For primary document see N82-14960 05-82)

Avail: NTIS HC A14/MF A01 CSCL 05B

The question, 'What is Technical Writing?', is addressed. Interest about the stance a teacher assumes in a classroom, the orientation of textbooks, and the shape of curricula are considered. Technical writing is considered of age, definitions abound and the time is ripe for a metaperspective on the question. This analyzes pitfalls in representative definitions of technical writing suggest a direction for future inquiry. M.D.K.

**N82-14962*#** Pittsburg State Univ., Kans.

**TECHNICAL WRITING IN AMERICA: A HISTORICAL PERSPECTIVE**

Michael E. Connaughton *In* NASA. Langley Research Center Tech. Commun. Pt. 1 Dec. 1981 p 15-24 refs (For primary document see N82-14960 05-82)

Avail: NTIS HC A14/MF A01 CSCL 05B

The standard distinction between poetic and referential language, the gulf between science and the humanities, and the distress many teachers of English feel when faced for the first time with the prospect of teaching technical writing are discussed. In the introduction of many technical writing textbooks. Technical communication is divorced from other forms of linguistic experience by making language limiting and reductive rather than creative and expansive. The emphasis on technical/scientific writing as radically different had blinded people to those traits it has in common with all species of composition and has led to a neglect of research, on fundamental rhetorical issues. A complete rhetorical theory of technical discourse should include information about the attitudes and motives of writers, the situations which motivate (or coerce) them to write, definitive features of technical style and form, interrelationship of expression and creativity, and functions of communication in shaping and preserving scientific networks and institutions. The previous areas should be explored with respect to contemporary practice and within an historical perspective. M.D.K.

**N82-14963*#** Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Language, Literature and Communication.

**TECHNICAL COMMUNICATION: NOTES TOWARD DEFINING DISCIPLINE**

Philip M. Rubens *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 25-31 refs (For primary document see N82-14960 05-82)

Avail: NTIS HC A14/MF A01 CSCL 05B

In the field of technical communication, definitions posited in virtually any major text violate every major rule of definitions. The most popular method for defining the field is to state that technical writing is any writing that supports technology or technological activities. There is a need for a nice yardstick for measuring what 'technology' is. Some ways in which the field can be defined in a tightly structured empirical way and some implications of technical communication for a humanistic education in a technological age are suggested. M.D.K.

**N82-14964*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

**MARKETING INFORMATION: THE TECHNICAL REPORT AS PRODUCT**

Freda F. Stoher (Old Dominion Univ.) and Thomas E. Pinelli *In its* Tech. Commun., Pt. 1 Dec. 1981 p 33-42 refs (For primary document see N82-14960 05-82)

Avail: NTIS HC A14/MF A01 CSCL 05B

Technical reports constitute a product, the primary means for communicating the results of research to the user. The Langley scientific and technical information (STI) review and evaluation project undertook a review of the technical report as an effective product for information communication. Style manuals describing theory and practice in technical report preparation; publication manuals covering such factors as design, layout, and type style; and copies of technical reports were obtained from industrial, academic, governmental, and research organizations. Based on an analysis of this material, criteria will be established for the report components, for the relationship of the components within the report context, and for the overall report organization. The criteria will be used as bench marks and compared with the publication standards currently used to prepare NASA technical reports. M.D.K.

**N82-14965*#** Wayne State Univ., Detroit, Mich.

**HOW TO DEVELOP AND WRITE A CASE FOR TECHNICAL WRITING**

Barbara Couture and Jone Goldstein *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 73-84 refs Submitted for publication (For primary document see N82-14960 05-82)

Avail: NTIS HC A14/MF A01 CSCL 05B

Case of different sizes and shapes for teaching technical writing to engineers at Wayne State University have been developed. The case approach was adopted for some assignments because sophomores and juniors lacked technical expertise and professional knowledge of the engineering world. Cases were found to be good exercises, providing realistic practice in specific writing tasks or isolating particular skills in the composing process. A special kind of case which narrates the experiences of one technical person engaged in the problem-solving process

in a professional rhetorical situation was developed. This type of long, realistic fiction is called a an 'holistic' case. Rather than asking students to role-play a character, an holistic case realistically encompasses the whole of the technical writing process. It allows students to experience the total communication act in which the technical task and data are fully integrated into the rhetorical situation and gives an opportunity to perform in a realistic context, using skills and knowledge required in communication on the job. It is believed that the holistic case most fully exploits the advantages of the case method for students of professional communication. M.D.K.

**N82-14966*#** *Illinois Inst. of Tech., Chicago. Dept. of Humanities.*

**EVALUATING THE EFFECTIVENESS OF CASE METHOD INSTRUCTION IN TECHNICAL COMMUNICATION**

Susan G. Feinberg *In* NASA. Langley Research Center Techn. Commun., Pt. 1 Dec. 1981 p 85-91 *Submitted for publication* (For primary document see N82-14960 05-82)

Avail: NTIS HC A14/MF A01 CSCL 05B

*The effectiveness of the case method as an instructional* technique in improving technical writing was evaluated. The development of a self-report instrument that attempts to measure *changes in attitude toward technical communication and the* presentation results change are the purpose of this paper. Standards for developing a case set forth by Goldstein and *Couture, were used to design an evaluation instrument to measure* the effect instruction on student attitude toward technical communication. This self-report instrument is based on *model developed and tested by Daly and Miller* who studied writer attitude and apprehension toward writing. It was the most *important objective of any evaluation is to provide information* for improving the program. M.D.K.

**N82-14967*#** *Cincinnati Technical Coll., Ohio.*

**USING CASE STUDIES TO TEACH AN ENGINEERING TECHNOLOGY TECHNICAL WRITING CLASS**

*Marcus M. Green In* NASA. Langley Research Center Tech. Commun. Pt. 1 Dec. 1981 p 93-98 refs (For primary document see N82-14960 05-82)

*Avail: NTIS HC A14/MF A01 CSCL 05B*

The use of the case method in teaching various technical *communication skills is described. Features of the method* considered include: solving communication problems, identifying an audience, planning written communications, presenting written *communications, and using visual aids.* S.L.

**N82-14968*#** Saint Louis Community Coll. at Meramec, Mo. **c02**

***WHY USE CASE STUDIES RATHER THAN SIMULATION-GAMING TECHNIQUES OR LIBRARY RESEARCH?***

Susan W. McDonald *In* NASA. *Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 99-103 refs* (For primary document see N82-14960 05-82)

*Avail: NTIS HC A14/MF A01 CSCL 05B*

*Method which present a student with a more challenging* and true to life situation of needing to conduct research in a *problem solving context--and not thinking about organization of* format until research and thinking are complete are investigated. Simulation-gaming techniques which attempt to teach initiative *and creativity that library research are used for this purpose.* However, it is shown case studies provide the greatest opportunities to engage the students in probelm solving situations in *which they develop skills as researchers and writers.* S.L.

**N82-14969*#** *Southwest Missouri State Univ., Springfield.*

**TEACHING GRAPHICS IN TECHNICAL COMMUNICATION CLASSES**

*Kristene C. Spurgeon In NASA. Langley Research Center Tech.* Commun., Pt. 1 Dec. 1981 p 115-129 refs (For primary document see N82-14960 05-82)

*Avail: NTIS HC A14/MF A01 CSCL 05B*

Graphic aids convey and clarify information more efficiently and accurately than words alone therefore, *most technical writing includes the use of graphics.* Ways of accumulating and presenting graphics illustrations on a shoestring budget are suggested. These include collecting graphics from companies, annual reports and laminating them for workshop use or putting them on a flip chart for classroom presentation, creating overhead transparencies to demonstrate different levels of effectiveness of graphic aids, and bringing in grahic artistis for question/answer periods or in class workshops. Also included are an extensive handout as an introduction to graphics, sample assignments, and a selected and annotated bibliography. S.L.

**N82-14970*#** Rensselaer Polytechnic Inst., Troy, N. Y.

**A GRAPHICS PRIMER FOR ENGLISH TEACHERS**

L. V. Brillhart (Triton Coll., River Grove, Ill.) and M. B. Debs *In* NASA. Langley Research Center Tech. Commun. Pt. 1 Dec. 1981 p 131-143 (For primary document see N82-14960 05-82)

Avail: NTIS HC A14/MF A01 CSCL 05B

Skills necessary for teaching graphics are addressed. A simple, step by step method of teaching students how to draw *different types of graphs is presented. Each step is illustrated* by a drawing. Some audience analysis for the determination of appropriateness of the use of different types of graphs is *included.* S.L.

**N82-14971*#** *Case Western Reserve Univ., Cleveland, Ohio.*

**APPLIED TAGMEMICS: A HEURISTIC APPROACH TO THE USE OF GRAPHIC AIDS IN TECHNICAL WRITING**

*Pamela P. Brownlee and Mary K. Kirtz In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 145-151 refs (For primary document see N82-14960 05-82)

*Avail: NTIS HC A14/MF A01 CSCL 05B*

In technical report writing, two needs which must be met if reports are to be useable by an audience *are the language needs and the technical needs of that particular audience.* A heuristic analysis helps to decide the most suitable format for information; *that is, whether the information should be presented verbally or* visually. The report writing process should be seen as an organic whole which can be divided and subdivided according to the *writer's purpose, but which always functions as a totality.* The tagmemic heuristic, because it itself follows a process of deconstructing and reconstructing information, lends itself to being *a useful approach to the teaching of technical writing. By applying* the abstract questions this heuristic asks to specific parts of the report. The language and technical needs of the audience *are analyzed by examining the viability of the solution within the* givens of the corporate structure, and by deciding which graphic or verbal format will best suit the writer's purpose. *By following such a method, answers which are both specific and thorough* in their range of application are found. S.L.

**N82-14972*#** National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

***CLINICAL REPORT WRITING: PROCESS AND PERSPECTIVE***

Helen Rothschild Ewald *In its Tech. Commun. Pt. 1 Dec.* 1981 p 163-171 refs (For primary document see N82-14960 05-82)

*Avail: NTIS HC A14/MF A01 CSCL 05B*

Clinical report writing in psychology and psychiatry is addressed. Audience/use analysis and the basic procedures of *information gathering, diagnosis, and prognosis are described.* Two interlinking processes are involved: the process of creation and the process of communication. Techniques for good report *writing are presented.* S.L.

**N82-14973*#** *Syracuse Univ., N. Y.*

**PREPARING FOR AN INFLUX OF FOREIGN STUDENTS IN TECHNICAL WRITING COURSES: UNDERSTANDING *THEIR BACKGROUND***

Carol S. Lipson *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 173-179 *refs (For primary document see N82-14960 05-82)*

Avail: NTIS HC A14/MF A01 CSCL 05B

*The cultural and historical influences that students from foreign* countries bring with them to technical and report writing classes, in particular those influences that would affect their receipt of *instruction in American principles for written prose are examined.* The grouping of sentences into idea units and into paragraphs, and the grouping of the paragraphs into whole structures *are considered. The different cultures, different habits and norms for* handling prose, and the dictates for style and structure and sufficiency and approach *are also considered.* S.L.

**N82-14974*#** Florida Atlantic Univ., Boca Raton. Dept. of Communication.
**ENLIGHTENED USE OF PASSIVE VOICE IN TECHNICAL WRITING**
M. K. Trammell *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 181-190 refs (For primary document see N82-14960 05-82)
Avail: NTIS HC A14/MF A01 CSCL 05B

The passive voice as a normal, acceptable, and established syntactic form in technical writing is defended. Passive/active verb ratios, taken from sources including 'antipassivist' text books, are considered. The suitability of the passive voice in technical writing which involves unknown or irrelevant agents is explored. Three 'myths' that the passive (1) utilizes an abnormal and artificial word order, (2) is lifeless, and (3) is indirect are considered. Awkward and abnormal sounding examples encountered in text books are addressed in terms of original context. Unattractive or incoherent passive sentences are explained in terms of inappropriate conversion from active sentences having (1) short nominal or pronominal subjects or (2) verbs with restrictions on their passive use. N.W.

**N82-14975*#** Arizona Univ., Tucson. Dept. of English.
**THE PROBLEMS INHERENT IN TEACHING TECHNICAL WRITING AND REPORT WRITING TO NATIVE AMERICANS**
Jean Zukowski/Faust *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 199-209 refs (For primary document see N82-14960 05-82)
Avail: NTIS HC A14/MF A01

Teaching technical writing to Native Americans contending with a second language and culture is addressed. Learning difficulties arising from differences between native and acquired language and cultural systems are examined. Compartmentalized teaching, which presents the ideals of technical writing in minimal units, and skills development are considered. Rhetorical problems treated include logic of arrangement, selection of support and scope of detail, and time and space. Specific problems selected include the concept of promptness, the contextualization of purpose, interpersonal relationships, wordiness, mixture of registers, and the problem of abstracting. Four inductive procedures for students having writing and perception problems are included. Four sample exercises and a bibliography of 13 references are also included. N.W.

**N82-14976*#** Washington Univ., Seattle. Scientific and Technical Communication Program.
**WRITING AS DECISION-MAKING**
James W. Souther *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 239-243 refs (For primary document see N82-14960 05-82)
Avail: NTIS HC A14/MF A01 CSCL 05B

The need to teach informational writing as a decision-making process is discussed. Situational analysis, its relationship to decisions in writing, and the need for relevant assignments are considered. Teaching students to ask the right questions is covered. The need to teach writing responsiveness is described. Three steps to get started and four teaching techniques are described. The information needs of the 'expert' and the 'manager' are contrasted. N.W.

**N82-14977*#** Delaware Univ., Newark. Dept. of English.
***INTEGRATE ORAL COMMUNICATION WITH TECHNICAL* WRITING: TOWARDS A RATIONALE**
Terry Skelton *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 255-259 refs (For primary document see N82-14960 05-82)
Avail: NTIS HC A14/MF A01 CSCL 05B

Integrating oral communication and technical writing instruction, to give students the opportunity to learn and practice interpersonal skills, is proposed. By linking speech and writing the importance of small-group interaction in developing transferable ideas is acknowledged. Three reasons for integration are examined: workday activities, application of role-taking to writing, and conflict resolution. Four advantages of integration are stated. N.W.

**N82-14978*#** Michigan Technological Univ., Houghton. Dept. of Humanities.
**TOWARD DEFINING GOOD WRITING: A RHETORICAL ANALYSIS OF THE WORDS, SENTENCES, AND PARAGRAPHS IN 16 INDUSTRIAL SCRIPTS**
Randall R. Freisinger and Bruce T. Petersen *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 291-304 refs (For primary document see N82-14960 05-82)
Avail: NTIS HC A14/MF A01 CSCL 05B

The assumption that teachers of technical writing agree on a definition of good writing was found to be without basis. Resolution of disagreements arising from close reading and textual analysis is described. Writing samples from corporate sources including IBM, ALCOA, Exxon, Weyerhaeuser, Bell Labs, Underwriters Laboratories, Dow Chemical, and US Steel were requested. A mixture of informative and persuasive examples, and examples directed at lay and specialist audiences were received. Analyses of 16 writing samples are reported. Analysis of word level, sentence level, and paragraph level, was completed. Syllabism, verb selection, nominalizations, vocabulary choices, t-units, subordination, sentence and clause length, syntactic order, patterns, development, topic sentences, propositional order, and transitions were analyzed. N.W.

**N82-14979*#** Michigan Univ., Ann Arbor. Dept. of Humanities.
***RESEARCH IN THE COMPREHENSION OF ENGINEERING* LECTURES BY NON-NATIVE SPEAKERS**
Leslie A. Olsen and Thomas N. Huckin *In* NASA. Langley Research Center Tech. Commun., Pt. 1 Dec. 1981 p 305-311 refs (For primary document see N82-14960 05-82)
Avail: NTIS HC A14/MF A01 CSCL 05B

Failure by foreign students to perceive the rhetorical structure or overall organization of an engineering lecture, rendering them unable to understand it, is discussed. Equally serious failure by such students to percieve the organizing role of theory in structuring the activities in their field is reported. Failure to identify the role of theory in the problem-solving process that underlies engineering is emphasized. Engineering was not seen as a series of on-going problems where each stage of solution exposed new problems to be solved. Implications for course planners and material designers are discussed. N.W.

***N82-14980#*** Defense Technical Information Center, Alexandria, Va. Office of Information Systems and Technology.
***DEFENSE* TECHNICAL INFORMATION CENTER FREE TEXT EXPERIMENT: MANAGEMENT DATA BASES *Information* Retrieval Report, Jan. - Jul. 1981**
Carlyan J. Thompson Oct. 1981 35 p refs
(AD-A105570) Avail: NTIS HC A03/MF A01 CSCL 05/2

DTIC has conducted an experiment that utilizes the free text inversion technique to retrieve records from the DROLS management data bases. It was felt that free text inversion as a form of retrieval would be beneficial in supporting DTIC's revitalized role in the transfer of technical information. The intent of this project was to determine if the free text inversion technique could be implemented in the management data bases without severely impacting the on-line system. Response time, storage capacity and relevance of reports were the major areas of concern. GRA

## 83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

**N82-14981#** Strasbourg Univ. (France). Bureau d'Economie Theorique et Appliquee.
**ECONOMIC EFFECTS INDUCED BY ESA CONTRACTS. PHASE 2. VOLUME 1: SUMMARY [LES EFFETS ECONOMIQUES INDUITS DES CONTRATS DE L'ESA. PHASE 2. VOLUME 1: RESUME]**
Patrice Brendle, Patrick Cohendet, Jean-Alain Heraud, Regis LaruedeTournemine, Helwig Schmied, Daniel Vitry, and Ehud Zuscovitch Paris ESA Jun. 1980 22 p In FRENCH 3 Vol.

(Contract ESA-3702/78/F-DKR(SC))
(ESA-CR(P)-1462-Vol-1) Avail: NTIS HC A02/MF A01

Different effects are classified by: technological advantages; commercial gains; organization and methodological advances; and impact on employment. Exports and limiting, or substitution for, imports are considered. Advantages other than space research were estimated for each sector of the economy and by country. Project Meteosat is shown to be of particular value. Results show that innovations due to ESA funding center on two essential activities: processing, storage and dissemination of information; and conditioning, storage and distribution of energy.
Author (ESA)

**N82-14982#** Strasbourg Univ. (France). Bureau d'Economie Theorique et Appliquee.
**ECONOMIC EFFECTS INDUCED BY ESA CONTRACTS. PHASE 2. VOLUME 2: MAIN REPORT [LES EFFETS ECONOMIQUES INDUITS DES CONTRATS DE L'ESA. PHASE 2. VOLUME 2: RAPPORT PRINCIPAL]**
Patrice Brendle, Patrick Cohendet, Jean-Alain Heraud, Regis LaruedeTournemine, Helwig Schmeid, Daniel Vitry, and Ehud Zuscovitch Paris ESA Jun. 1980 148 p refs In FRENCH 3 Vol.
(Contract ESA-3702/78/F-DKR(SC))
(ESA-CR(P)-1462-Vol-2) Avail: NTIS HC A07/MF A01

Technological advantages, commercial gains, organizational and methodological advances, and impact on employment are discussed. Quantitative results are given by sector of the economy, country and by contracting industry. The exceptional utility of project Meteosat is revealed. Innovations achieved in the distribution of productivity and technological independence won through ESA efforts are considered. Author (ESA)

**N82-14983#** Strasbourg Univ. (France). Bureau d'Economie Theorique et Appliquee.
**ECONOMIC EFFECTS INDUCED BY ESA CONTRACTS. PHASE 2. VOLUME 3: THEORY AND METHOD [LES EFFETS ECONOMIQUES INDUITS DES CONTRATS DE L'ESA. VOLUME 3: RAPPORTS THEORIQUE ET METHODOLOGIQUE]**
Patrice Brendle, Patrick Cohendet, Jean-Alain Heraud, Regis LaruedeTournemine, Helwig Schmied, Daniel Vitry, and Ehud Zuscovitch Paris ESA Jun. 1980 57 p refs In FRENCH 3 Vol.
(Contract ESA-3702/78/F-DKR(SC))
(ESA-CR(P)-1462-Vol-3) Avail: NTIS HC A04/MF A01

The economic utility of ESA contracts to the European community was determined. The economic impact of R and D was cost/benefit analyzed, macroeconomically and microeconomically. Results are given as: technological effects; commercial gains; organizational and methodological advances; and influences of ESA contracts on contractor personel. Project Meteosat is taken as an example. Data acquisition is discussed. The statistical significance of the sample is shown. Author (ESA)

**N82-14984#** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Abteilung Flugverkehrswissenschaft.
**SCENARIOS OF ECONOMIC DEVELOPMENT WITHIN THE EUROPEAN COMMUNITY UNTIL THE YEAR 2000**
Hermann Keimel and Alfons Schmitt Feb. 1981 174 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-730)
(DFVLR-FB-81-08) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 28,70

A tendency scenario is projected in order to assess the influence of the European economy on the need for long-distance transportation, i.e. by air. The tendency scenario is supplemented with two additional scenarios which illustrate possible trends in the European Economic Community either towards a technology based economy or towards a service economy. In the technology scenario it is assumed that after a stagnative period of transition economic growth impetus will result from technological innovations and world trade expansion. The service economy scenario describes a situation of low economic growth paralleled by strong expansion in the service sector. Based on the qualitative characteristics of the scenarios, quantitative forecasts are made on economic structure.
Author (ESA)

# 84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

**N82-14198#** British Telecom International (England).
**THE USE OF OTS IN THE COST 211 PROJECT**
J. R. Taylor *In* ESA OTS: 3rd Year in Orbit Aug. 1981 p 132-133 (For primary document see N82-14173 05-12)
Avail: NTIS HC A10/MF A01

# 85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

**N82-14985*#** New York Univ., N. Y. Center for Science and Technology Policy.
**THE CHANGING TIDE: FEDERAL SUPPORT OF CIVILIAN-SECTOR R AND D**
Herbert I. Fusfeld, Richard N. Langlois, and Richard R. Nelson 1 Nov. 1981 151 p refs
(Grant NsG-7636)
(NASA-CR-165048) Avail: NTIS HC A08/MF A01 CSCL 05A

The involvement of the Federal government in civilian sector research and development is discussed. Relevant policies are put in an historical perspective. The roles played by industrial research and public funding are reveiwed. Government support of basic an generic research, clientele-oriented applied research, and research with commercial ends is studied. Procurement, anti-trust, and patent policies, all of which affect the climate for private research and development, are examined. R.J.F.

**N82-14986*#** New York Univ., N. Y. Center for Science and Technology Policy.
**TECHNICAL CHANGE IN US INDUSTRY: A CROSS-INDUSTRY ANALYSIS**
Richard R. Nelson, ed. 1 Nov. 1981 482 p refs
(Grant NsG-7636)
(NASA-CR-165047) Avail: NTIS HC A21/MF A01 CSCL 05A

The nature of the public policies which have influenced the pace and pattern of technical progress in a number of American industries is studied with the view of assessing the broad effects of these policies. The industries studied are agriculture, pharmaceuticals, semiconductors, computers, civil aircraft, automobiles and residential construction. The policies considered include research and development funding as well as government procurement, education, information dissemination, patent protection, licensing, regulations, and anti-trust policies. R.J.F.

**N82-14987#** California Univ., Livermore. Lawrence Livermore Lab.
**FUTURE OF ELECTRICITY FOR AUTOMOBILES: ADVANCED ELECTRIC VEHICLE CONCEPTS**
Lawrence G. OConnell 29 Jul. 1981 14 p refs Presented at 6th Elec. Vehicle Council Symp., Baltimore, 21 Oct. 1981
(Contract W-7405-eng-48)
(DE81-028235; UCRL-85526; CONF-811010-3) Avail: NTIS HC A02/MF A01

An electric vehicle, hybrid vehicle, and other nonpetroleum electricity based systems, such as a fuel cell vehicle are evaluated. Performance criteria for such vehicles are presented and, in addition, various concepts that may be suitable for these

vehicles are identified-their capabilities are discussed as well as the difficulties that must be overcome prior to commercialization in each case. DOE

**N82-14988#** Ecole Nationale Superieure de Techniques Avancees, Paris (France).
**[RESEARCH ACTIVITIES REPORT IN ADVANCED TECHNOLOGY] Annual Report, 1980 [RAPPORT D'ACTIVITE SUR LES RECHERCHES A L'ECOLE NATIONALE SUPERIEURE DE TECHNIQUES AVANCEES EN 1980]**
1980 124 p refs In FRENCH Original contains color illustrations
Avail: NTIS HC A06/MF A01

Scientific and experimental research is reported on. Work centers on chemistry, hydrothermodynamics data processing and information sciences, materials science, structural engineering, and optics. Author (ESA)

**N82-14989#** Approved Engineering Test Labs., Fullerton, Calif.
**OCCUPANT RESPONSE AND VEHICLE ACCELERATION IN A 30 MPH FRONTIAL IMPACT TEST, 1981 SUBARU DL, 4 WHEEL DRIVE, 4 DOOR WAGON, NHTSA 811301 Final Report, Jan. - Feb. 1981**
D. H. Hand 10 Jun. 1981 111 p
(Contract DOT-HS-9-02273)
(PB81-228769; DOT-HS-805917; Rept-971-3882-35) Avail: NTIS HC A06/MF A01 CSCL 13F

Occupant and vehicle research is interested in obtaining information on various impact modes and vehicles types through staged collisions. The information collected includes occupant injury measurements as well as seat belt loads, and vehicle acceleration. T.M.

**N82-14990#** General Motors Technical Center, Warren, Mich. Transportation Systems Div.
**SYSTEMS OPERATION STUDIES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS. FEEDER SYSTEMS MODEL FUNCTIONAL SPECIFICATION Final Report**
T. M. Linden Jun. 1981 37 p
(Contract DOT-TSC-1220)
(PB81-233496; DOT-TSC-UMTA-81-14;
UMTA-MA-06-0048-81-1) Avail: NTIS HC A03/MF A01; also available in set of 5 reports HC E15 as PB81-223488 CSCL 13F

The objective of the FSM is to map the zone-to-zone transit patronage demand onto AGT station pairs and to generate feeder system performance data. The output of this model can be used in conjunction with AGT data in order to provide normalized comparisons between different AGT systems operating in the same demand environment with both conventional feeder service/AGT operation and dual mode feeder/AGT operation. Because of its generic nature, the model is recommended for representative AGT deployments comparison only. GRA

**N82-14991#** General Motors Technical Center, Warren, Mich.
**SYSTEMS OPERATION STUDIES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS: SYSTEM AVAILABILITY MODEL USER'S MANUAL Final Report**
Robert Oglesby Jun. 1981 70 p refs
(Contract DOT-TSC-1220)
(PB81-233504; DOT-TSC-UMTA-81-12;
UMTA-MA-06-0048-81-2) Avail: NTIS HC A04/MF A01 CSCL 13F

The System Availability Model (SAM) is a system level model which provides measures of vehicle and passenger availability. The SAM operates in conjunction with the AGT discrete Event Simulation Model (DESM). The DESM output is the normal source of the delays information portion of the SAM's input data set. There is no inherent restriction on the systems applicability of the SAM. Therefore, the range of applicability of the DESM defines the ranges of applicability for the SAM. This SAM user's manual describes the program, its input requirements, and its operating procedures. The maintenance and standby fleet size required to support the operational fleet are also determined. GRA

**N82-14992#** General Motors Technical Center, Warren, Mich. Transportation Systems Div.
**SYSTEMS OPERATION STUDIES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS. AVAILABILITY MODEL FUNCTIONAL SPECIFICATION Final Report**
T. M. Linden and J. D. Boldig Jun. 1981 54 p
(Contract DOT-TSC-1220)
(PB81-233512; DOT-TSC-UMTA-81-15;
UMTA-MA-06-0048-81-3) Avail: NTIS HC A04/MF A01; also available in set of 5 reports HC E15 as PB81-233488 CSCL 13F

The System Availability Model (SAM) is a system level model which provides measures of vehicle and passenger availability. The SAM evaluates the system level influence of availability concepts employed in AGT systems. This functional specification identifies the functions performed, the types of hardware required and the modeling techniques employed by the SAM. This model is sufficiently flexible to aid transportation system planners in AGT system selection. GRA

**N82-14993#** General Motors Technical Center, Warren, Mich. Tranportation Systems Div.
**SYSTEMS OPERATION STUDIES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS. SYSTEM AVAILABILITY MODEL PROGRAMMER'S MANUAL Final Report**
Robert Oglesby Jun. 1981 153 p
(Contract DOT-TSC-1220)
(PB81-233520; DOT-TSC-UMTA-81-13;
UMTA-MA-06-0048-81-4) Avail: NTIS HC A08/MF A01 CSCL 13F

The manual describes the program's functions, organization, variables, and processing algorithms. Debug tools built into the model, a global variable dictionary, subprogram logic tables, and subprogram descriptions are also described to aid maintenance and modification of this model. T.M.

**N82-14994#** General Motors Technical Center, Warren, Mich. Transportation Systems Div.
**SYSTEMS OPERATION STUDIES FOR AUTOMATED GUIDEWAY TRANSIT SYSTEMS. DETAILED STATION MODEL FUNCTIONAL SPECIFICATION Final Report**
J. Bender Jul. 1981 48 p
(Contract DOT-TSC-1220)
(PB81-233538; DOT-TSC-UMTA-81-16;
UMTA-MA-06-0048-81-5) Avail: NTIS HC A03/MF A01; also available in set of 5 reports HC E15 as PB81-233488 CSCL 13F

The Detailed Station Model (DSM) is a discrete event model representing the interrelated queueing processes associated with vehicle and passenger activities in an AGT station. The DSM provides operational and performance measures of alternative station configurations and management policies with respect to vehicle and passenger handling capabilities and provides an analytic tool to support trade studies. Its architecture facilitates interchange of alternative operational strategy algorithms and station traffic flow patterns to assist in the initial design selection by planners. GRA

## 88 SPACE SCIENCES (GENERAL)

**N82-14995#** University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
**INTERSTELLAR GRAINS INVESTIGATED AND COMETS PROPOSED AS A VEHICLE FOR PANSPERMIA**
F. Hoyle and N. C. Wickramasinghe Nov. 1980 49 p refs Submitted for publication
(Preprint-65) Avail: NTIS HC A03/MF A01

The nature and composition of interstellar grains, and the role of comets in bringing life to Earth, are discussed. For individual titles, see N82-14996 through N82-14997.

**N82-14996#** University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
**INTERSTELLAR GRAINS** **c90**
F. Hoyle and N. C. Wickramasinghe *In its* Interstellar Grains Investigated and Comets Proposed as a Vehicle for Panspermia

Nov. 1980 26 p refs (For primary document see N82-14995 05-88)
Avail: NTIS HC A03/MF A01

Interstellar extinction of starlight was observed and plotted as a function of inverse wavelength. Agreement with the calculated effects of the particle distribution is shown. The main kinds of grain distinguished are: (1) graphite spheres of radius 0.02 microns, making up 10% of the total grain mass; (2) small dielectric spheres of radius 0.04 microns making up 25%; and (3) hollow dielectric cylinders containing metallic iron, with diameters of 2/3 microns making up 45%. The remaining 20% consists of other metals, metal oxides, and polysiloxanes. Absorption factor evidence suggests that the main dielectric component of the grains is organic material. Author (ESA)

**N82-14997#** University Coll., Cardiff (Wales). Dept. of Appiied Mathematics and Astronomy.
**COMETS: A VEHICLE FOR PANSPERMIA** **c91**
Fred Hoyle and Chandra Wickramasinghe *In its* Interstellar Grains Investigated and Comets Proposed as a Vehicle for Panspermia Nov. 1980 22 p refs Presented at 5th College Park Colloq. on Chemical Evolution, College Park, MD., 29-31 Oct. 1980 (For primary document see N82-14995 05-88)
Avail: NTIS HC A03/MF A01

Arguments are given for life being a cosmic phenomenon, which comets carry amplify and disperse throughout the universe. The overall atomic composition of comets agrees well with that of living materials. Since organic matter and water are present in comets, there is potentially an excellent culture medium for some types of microorganism. The melted interiors of comets are well suited to the amplification of autotrophic anaerobic bacteria. The frozen exteriors could preserve almost all forms of microorganism known to exist on Earth today. The Earth receives over 10 to the 18th power viable cells per year as a result of the deposition of cometary particles at the top of the atmosphere. The various environments of the Earth offer ample scope for development to the particles which do not perish. Author (ESA)

# 89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

**N82-14998#** Royal Observatory, Edinburgh (Scotland).
**OPTICAL PERFORMANCE DATA FOR THE UK INFRARED TELESCOPE; ATMOSPHERIC SEEING EFFECTS IN THE INFRARED**
C. M. Humphries and T. E. Purkins 1 Dec. 1980 25 p refs (UKIRT-16; ISSN-0260-9983) Avail: NTIS HC A02/MF A01

Aperture diffraction modulation transfer functions (MTF) were calculated at wavelengths from 0.5 to 10 microns, for a primary aperture of 3.8m, and a secondary diameter of 0.95m. Measured MTF at 0.5 to 4 microns for UKIRT optics is compared with aperture diffraction MTF, including the effect of average seeing conditions. Wavelength dependent MTF under good atmospheric seeing conditions, i.e. 0.5, 1, and 2 arcsec seeing, are presented with point spread functions. Performance matches predictions. The theory of MTF is introduced. It measures the modulation or contrast of features in the exit pupil at various spatial frequencies and expresses them in linear or angular separation distances. Author (ESA)

# 90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

**N82-14999*#** California Univ., Berkeley. Space Sciences Lab.
**UNIVERSITY OF CALIFORNIA ELECTRON AND X-RAY EXPERIMENTS ON ISEE-3, SERIES 22, ISSUE 5 Technical Progress Report, 1 Feb. 1980 - 28 Feb. 1981**
Kinsey A. Anderson Mar. 1981 10 p refs
(Contracts NAS5-22307; NAS5-25980)
(NASA-CR-166725) CSCL 03B

Some results of the solar electron and X-ray experiments onboard the International Sun Earth Explorer 3 are briefly discussed. The production of plasma waves and the generation of type 3 solar radio emission were analyzed using measurements of the electron distribution function. Measurements of bow shock particles far upstream from Earth and of low energy electrons and ions during long-lived solar particle events were examined. An analysis of the propagation of low energy electrons indicates that the pitch angle distributions of solar electrons are highly varied, complex and rapidly changing. The use of X-ray data to investigate solar flares is described. M.G.

**N82-15000*#** TRW Defense and Space Systems Group, Redondo Beach, Calif. Space Sciences Dept.
**PLASMA WAVE EXPERIMENT FOR THE ISEE-3 MISSION Semiannual Report, 20 Feb. - 19 Aug. 1981**
Frederick L. Scarf 19 Aug. 1981 70 p refs
(Contracts NAS5-20682; NAS5-20093; NAS7-100; Grant NGL-16-001-043)
(NASA-CR-166730; Rept-23499-6024-UT-00; SAR-3) CSCL 03B

Analyses of data from the scientific instrument designed to study solar wind and plasma wave phenomena on the International Sun Earth Explorer 3 are presented. Plasma turbulence upstream and downstream of interplanetary shocks was detected. The microscopic plasma waves associated with interplanetary shocks were studied in the broad context of a discussion of some potential contributions to collisionless shock and cosmic ray acceleration theories. The central issue here was whether heated ions create magnetohydrodynamic turbulence as part of the quasi-parallel shock structure. The analysis suggests that the plasma physics near the Earth's bow shock may apply to interplanetary shocks on a far larger scale. Additional analyses concerning whistler mode wave propagation and Earth's foreshock structure are briefly described. R.J.F.

**N82-15001*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**THE DISCOVERY OF 50 MINUTE PERIODIC ABSORPTION EVENTS FROM 4U1915-05**
N. E. White and J. H. Swank Oct. 1981 18 p refs Submitted for publication
(NASA-TM-83839) Avail: NTIS HC A02/MF A01 CSCL 03B

The steady flux from 4U1916-05 which undergoes periodic absorption dips every 50 minutes was demonstrated. This period represents the underlying orbital period of the system. It is suggested that variations in the depth and duration of these events are caused by a bulge in the edge of the accretion disk, at the point where the gas stream impacts the disk. The mass losing star in this system is probably a low mass white dwarf. The spectrum of the dips indicates that the metallicity of the absorbing material is at least a factor 17 below solar values. E.A.K.

**N82-15002#** University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
**THE 3.4 MICRON INTERSTELLAR ABSORPTION FEATURE AND THE ORGANIC COMPOSITION OF INTERSTELLAR GRAINS**
D. T. Wickramasinghe, D. A. Allen, F. Hoyle, and N. C. Wickramasinghe Jun. 1980 16 p refs Submitted for publication
(Preprint-61) Avail: NTIS HC A02/MF A01

The nature of interstellar matter is examined by infrared spectroscopy. The 3.4 micron absorption feature is believed to arise in the general interstellar medium. The interstellar grains are organic, existing in polymeric form. For individual titles, see N82-15003 through N82-15004.

**N82-15003#** University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
**THE 3.4 MICROMETER INTERSTELLAR ABSORPTION FEATURE**
D. T. Wickramasinghe (Royal Observatory, Edinburgh) and D. A. Allen (Anglo-Australian Observatory, Epping, Australia) *In its*

The 3.4 Micron Interstellar Absorption Feature and the Organic Composition of Interstellar Grains Jun. 1980 9 p refs Submitted for publication (For primary document see N82-15002 05-90)
Avail: NTIS HC A02/MF A01

The presence of the 3.4 micrometer absorption feature in the source IRS 7 is shown. The ratio of the absorption coefficient of grains at 3.4 micrometers to the extinction coefficient at lambda V = 5500A is shown to be in the range 0.003 to 0.006. The wavelength of the peak absorption is 3.39 micrometers, + or - 0.03 micrometers; the equivalent width 330A, and the intrinsic full width at half maximum 0.13 micrometers. The 3.4 micrometer absorption is believed to arise in the general interstellar medium, and not in the dense molecular clouds where absorption due to other CH and CC bonds is known to occur. A circumstellar origin is also discounted. A substantial fraction of carbon in the interstellar medium is deduced to be in the form of organic molecules in grains. Visual extinction coefficient equals 5500A. This is consistent with observational data. The band center varies slightly from one polysaccharide to another but is again consistent with observational data. Author (ESA)

**N82-15004#** University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
**THE ORGANIC COMPOSITION OF INTERSTELLAR GRAINS**
D. T. Wickramasinghe (Royal Observatory, Edinburgh), F. Hoyle, and N. C. Wickramasinghe *In its* The 3.4 Micron Interstellar Absorption Feature and the Organic Composition of Interstellar Grains Jun. 1980 6 p refs Submitted for publication (For primary document see N82-15002 05-90)
Avail: NTIS HC A02/MF A01

Polyformaldehyde is examined as a possible organic component of interstellar grains. Absorption coefficients are determined from calibrated infrared spectra. The CH band center is at 3.4 microns and the visual extinction coefficient equals 5500A. This is consistent with observational data. The band center varies slightly from one polysaccharide to another but is always consistent with observational data. Grains are thus thought to exist in polymeric form. Author (ESA)

**N82-15005#** State Univ. of New York, Albany.
**RESEARCH IN NUCLEAR ASTROPHYSICS: STELLAR COLLAPSE AND SUPERNOVAE Progress Report, 1 Dec. 1981 - 30 Nov. 1984**
T. J. Mazurek and J. M. Lattimer 1981 40 p refs Prepared in cooperation with State Univ. of New York at Stony Brook
(Contract DE-AC02-80ER-10719)
(DE81-030041; DOE/ER-10719/T1) Avail: NTIS HC A03/MF A01

The implications of nuclear theory for the final collapse of massive stars is examined. The development of an appropriate nuclear equation of state and its implementation in hydrodynamics are studied. The influence of nuclear dissociation and neutrino emission on the formation and propagation of shocks are investigated. The long term evolution of collapsed stellar cores after the initial hydrodynamic bounce, neutrino production and emission in all phases are derived, and potential effects of pion condensation and neutrino instabilities are explored. DOE

**N82-15006** California Univ., Santa Cruz.
**ROTATIONAL VELOCITIES AND AGES OF SOLAR-TYPE STARS Ph.D. Thesis**
David Robert Soderblom 1980 88 p
Avail: Univ. Microfilms Order No. 8123249

Data needed to discuss the rotational history of solar-type stars and the relation of angular momentum loss to other physical phenomena are provided. High resolution spectral lin profiles were obtained for 82 stars and were modeled to yield rotational velocities. The available Li data were reanalyzed to derive an age calibration for field stars. The Li age relation indicates that stars of solar mass one have undergone pre-main-sequence Li depletion by a factor of two to five. The field star and cluster data indicate a relation that was predicted from models of angular momentum loss through stellar wind forced to corotate by a magnetic field. Rapid rotation does not enhance Li depletion, nor is it likely that it enhances the mass loss rate or the Alfven radius. It is possible, but not certain, that slow rotation inhibits Li depletion. Dissert. Abstr.

**N82-14996#** University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
**INTERSTELLAR GRAINS**
F. Hoyle and N. C. Wickramasinghe *In its* Interstellar Grains Investigated and Comets Proposed as a Vehicle for Panspermia Nov. 1980 26 p refs (For primary document see N82-14995 05-88)
Avail: NTIS HC A03/MF A01

# 91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

**N82-15007*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab.
**KOHOUTEK, PHOTOMETRIC PHOTOGRAPHY EXPERIMENT (S233) Final Report**
C. A. Lundquist and Paul D. Craven Oct. 1981 35 p refs (NASA-TM-82449) Avail: NTIS HC A03/MF A01 CSCL 03B

The final results of the Skylab 4 experiment S233, Kohoutek photometric photography experiment, which undertook a series of visible light photographs suitable for photometry and for a photographic history of Comet Kohoutek are described. The experiment concept, the data reduction method, and the results obtained are discussed. B.W

**N82-14109#** Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Astrophysik.
**PLASMA FLOW AND MAGNETIC FIELDS IN COMETS**
H. U. Schmidt and R. Wegmann *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 3-7 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14114#** Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
**SIZE DISTRIBUTION, STRUCTURE, AND CHEMICAL COMPOSITION OF COMETARY DUST PARTICLES**
Hugo Fechtig *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 47-52 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14117#** Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau (West Germany).
**DYNAMICS AND CHEMISTRY OF COMETARY COMAS: A PRE-GIOTTO VIEW**
W.-H. Ip *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 79-91 refs (For primary document see N82-14107 05-12)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14119*#** Smithsonian Astrophysical Observatory, Cambridge, Mass.
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Fred L. Whipple *In* ESA Sci. and Exptl. Aspects of the Giotto Mission Jun. 1981 p 101-103 refs (For primary document see N82-14107 05-12)
(Grant NsG-7082)
Avail: NTIS HC A08/MF A01; ESA, Paris FF 180 Member States, AU, CN and NO (+20% others)

**N82-14127#** European Space Operations Center, Darmstadt (West Germany).
**LUNAR GRAVITATIONAL FIELD DETERMINATION**
W. Flury *In* ESA Spacecraft Flight Dyn. Aug. 1981 p 37-45 refs (For primary document see N82-14123 05-12)
Avail: NTIS HC A22/MF A01; ESA, Paris FF 160 Member States, AU, CN and No (+20% others)

**N82-14997#** University Coll., Cardiff (Wales). Dept. of Applied Mathematics and Astronomy.
**COMETS: A VEHICLE FOR PANSPERMIA**
Fred Hoyle and Chandra Wickramasinghe *In its* Interstellar Grains Investigated and Comets Proposed as a Vehicle for Panspermia Nov. 1980 22 p refs Presented at 5th College Park Colloq. on Chemical Evolution, College Park, MD., 29-31 Oct. 1980 (For primary document see N82-14995 05-88)
Avail: NTIS HC A03/MF A01

## 92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

No abstracts in this category.

## 93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

## 99 GENERAL

**N82-15008*** National Aeronautics and Space Administration, Washington, D. C.
**HIGHLIGHTS OF 1981 ACTIVITIES**
23 Dec. 1981 20 p
(NASA-News-Release-81-199; P81-10203) Avail: NTIS Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22B

The highlights of NASA's 1981 activities are presented, including the results of the two flights of the space shuttle Columbia and the Voyager 2 encounter with Saturn. Accomplishments in the areas of space transportation operations; space science; aeronautical, energy, and space research and development; as well as space tracking, international activities, and 1981 launch activities are discussed. S.L.

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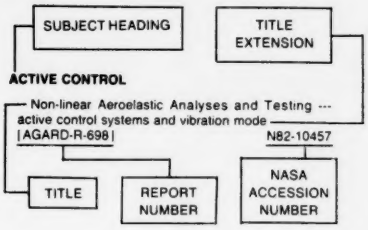


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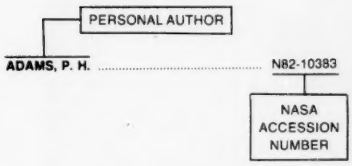


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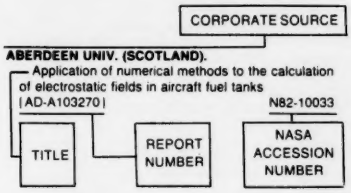


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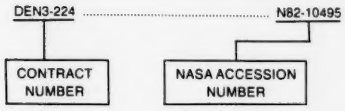


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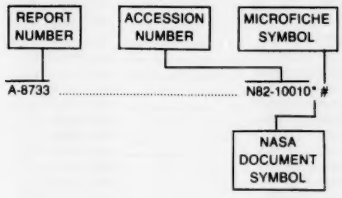


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